Compliments of
A. A. Woodworth
Chicopee
May 10" 1879

TWENTY-SIXTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

Massachusetts Board of Agriculture:

WITH

RETURNS OF THE FINANCES OF THE AGRICULTURAL SOCIETIES,

FOR

1878.

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STATE BOARD OF AGRICULTURE, 1879.

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Charles L. Flint, *Secretary.*

THE

TWENTY-SIXTH ANNUAL REPORT

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BOARD OF AGRICULTURE.

To the Senate and House of Representatives of the Commonwealth of Massachusetts.

The increased area devoted to the growth of Indian corn may be stated as one of the marked characteristics of the past farming season. The attention given to this beautiful crop had been gradually diminishing for some years, owing to an impression that there were other crops that could be raised at a greater profit. The fact that it is an article of prime necessity for consumption upon every farm, and that, wherever it can be raised at a cost less than the market-price, it must be desirable and profitable to grow it, seemed to be lost sight of. For two or three years a re-action has been going on in the minds of the farming community. Many careful experiments have been made; and the results appear to show that this crop can be produced at less than fifty cents a bushel, while it is seldom that it can be bought for that in the market.

Meantime new and improved methods have been tried: the use of concentrated fertilizers has greatly increased, and a more general substitution of machinery for hand-labor has been brought to bear to lessen the cost of cultivating a crop of corn. It may be that some other special crop can be made to pay better acre for acre, and that, as a money-crop raised to sell, a greater amount can be realized upon some of the

innumerable varieties of small fruit; but this is no argument for neglecting the cultivation of Indian corn, when it is apparent that it can be raised for less than it costs in the market.

In other respects, also, the season has been favorable to farm production, especially to the grass and hay crop, on which our prosperity so largely depends. No general and severe drought, to which we are liable every year, affected the crop through the growing season. The rainfall, though not large through the months of May and June, was well distributed over the period of growth; and the result of the grass-crop was satisfactory.

The yield of apples was unprecedented, while that of pears and grapes was light. The complaint has frequently been made that the apple-crop was so abundant, that the price was too low to make it pay to harvest and market it. There has been, no doubt, some ground for such a complaint; but it ought not to be overlooked that the apple is a most valuable food for stock, containing about ten per cent of nutriment, while the potato contains but thirteen, and that it can be fed out freely to advantage in such a season as the past.

I find great complaint among the owners of sheep and those who desire to engage in sheep-husbandry, of the inadequacy of the protection afforded by the "dog-law," so called. It is evident that it can be amended to advantage. Sheep are often injured by the worrying of useless curs, when no damages can be recovered under the law. They are often maimed, and rendered worthless, and the owner appeals in vain for redress. If a class of sheep especially valuable for the purity of blood and excellence of breeding suffers loss, the owner is met by the official authorities with the objection that a sheep is a sheep, and that no sheep is worth more than three or four dollars, or what it will bring at the butcher's. The result is to depress all enterprise for improving our flocks by the importation or breeding of high-cost animals. The owner of a low grade of sheep has the advantage over the owner of a pure-bred flock. Now the law has commended itself to public opinion, and will be enforced; and there seems to be no reason why it should not be made more effective, so as to operate as a powerful stimulus to the increase of the most useful stock of the farm.

The Board, at its last Annual Meeting, passed a vote requesting the societies receiving the bounty of the State to hold one or more farmers' institutes within their limits, promising at the same time to render all the aid in its power to make such institutes useful and attractive to the public. Some fifteen or twenty such institutes were held by the different societies in various parts of the State in March and April last. They were generally well attended, and are believed to have been appreciated, and productive of good. Several other similar gatherings have already been organized for the present winter. It was thought that local meetings could be managed better by the officers of the several societies than by the Board as a body, both so far as securing a hall and arranging for speakers were concerned; while the Board itself had no funds available to devote to the employment of lecturers or other incidental expenses. But such members of the Board as could conveniently attend have made it their duty to be present; and in various ways, by lectures and otherwise, the Board has given all the aid in its power upon such occasions, and will continue to do so.

In addition to these numerous meetings held by the county societies under the auspices of the Board, the regular public meetings of the Board have been continued, and have constantly increased in popularity and influence. They have been more largely attended every year; and a vast amount of useful and valuable information has been diffused through the medium of lectures of the highest scientific ability, and discussions of the greatest practical interest and importance. As an evidence that these efforts are more and more appreciated, it may be mentioned that the attendance of farmers has regularly increased, and that the enthusiasm has been kept up to the end of the protracted or three-days' sessions. When these public meetings were first inaugurated at Springfield in 1864, the most distinguished scientific men, like Professor Agassiz, Professor Johnson, and others, were not sufficient to secure a large and interested audience; while now they usually "fill the hall," and many farmers will go a hundred miles or more to attend the public meetings, and always find themselves abundantly repaid for their trouble. The information gathered there has thus made itself felt throughout the Commonwealth.

PUBLIC MEETING OF THE BOARD

AT HINGHAM.

The country meeting of the Board for 1878 was held at Agricultural Hall, in Hingham, Dec. 3, 4, and 5. The Chairman of the Committee of Arrangements, Edmund Hersey, Esq., of Hingham, representing the Hingham Society on the Board, called the meeting to order at ten o'clock on Tuesday, Dec. 3, and read the following address: —

Members of the Massachusetts Board of Agriculture, — As chairman of the committee of arrangements for this meeting, and as delegate of the Board for this section of Plymouth County, it becomes my duty to call this fifteenth annual public meeting of the Board to order; and as presiding officer of the Hingham Agricultural and Horticultural Society, in whose hall you are now assembled, it becomes my very pleasant duty to extend to you, and those who have come with you, a cordial welcome.

In welcoming you to this ancient county, I welcome you to that portion of New England where the republican form of government was first founded, where the rulers were first elected by the votes of all classes, and where was first founded our religious institutions and our free public schools. I also welcome you to a people in whose veins flows the blood of the Pilgrims.

Plymouth County occupies a position so prominent in the pages of history, that the landing of the Pilgrims, their hardships, their misfortunes, their determined and persistent efforts, their high integrity and final triumph, are all familiar to every reader of the English language. It is therefore unnecessary for me to enter into details relating to that little band who landed on Plymouth Rock, and whose descendants are now scattered throughout the length and breadth of the American Union.

I need hardly remind you that those principles which the Pilgrims taught are those higher principles which have been handed down to their descendants, and are to-day assisting in lifting up and improving the religious, the moral, the social and political condition of the people.

The early settlers not only understood the importance of laying the foundation for a good government and religious and educational institutions, but they also understood the important fact, that, if they would obtain good returns from mother earth, they must be generous with her; and so they liberally fertilized the soil with fish from the sea, even before they planted the seed, thus obtaining good crops, and at the same time enriched rather than impoverished the land.

As early as 1625 the crop of Indian corn was so large, that five hundred bushels at one time were sent to Kennebec, and exchanged for beaver-skins.

The soil and climate of this county are so well adapted to the growth of this grain, that the early settlers raised large quantities, and by so doing added very much to their resources.

For more than a hundred years the county produced more than sufficient grain for its home consumption. The first account I have been able to find of the importation of grain into the county was in 1775, when seven hundred bushels of Indian corn were purchased from Virginia: the price paid was seventy-five cents per bushel delivered.

Although, for more than a hundred years, the people have paid more attention to manufactures than to agriculture, they have never lost sight of the importance of united action to encourage the improvement of breeds of animals, and the varieties of fruits and vegetables, and to collect information of a character to assist them in applying labor and materials to their farms in a manner to secure the best results.

Early in the present century a farmers' club was formed in this town, and was in active operation some years.

The Plymouth County Agricultural Society was organized in 1819. Through the influence of this society, great improvements have been made in breeds of cattle and the methods of cultivating the soil. The records of this society show that more than a hundred and forty bushels of shelled corn have been produced upon one acre of land in one season.

The Hingham Agricultural and Horticultural Society was organized in 1858. This society has maintained regular monthly meetings from its organization to the present time: it has done more than this; during the twenty years of its existence it has averaged one meeting every seventeen days.

At these meetings a great variety of subjects has been discussed, and many able lectures given. Its annual exhibitions have shown that the members understand the importance of maintaining good order and of introducing no features which tend to demoralize the people. Premiums have been awarded to real merit, and have not been given to single points of excellence.

The Marshfield Agricultural Society was organized as a county society in 1866. This society has evidently done much to improve the condition of the farmer in that portion of the county: its yearly exhibitions bring together a large number of people, and give them an opportunity to renew their acquaintanceship, and to learn the progress each has made in agriculture during the year.

Brockton has a town society, which holds an annual exhibition.

Hanson has a farmers' club, which has held two exhibitions.

Thus Plymouth County has five societies that are laboring to improve the condition of the farmer; which is conclusive evidence, that, however largely the people may be engaged in manufactures, they realize the importance of organizing, and keeping in active operation, institutions that will keep them informed of every step of progress that is made in agriculture.

Soon after the landing of the Pilgrims, ship-building was commenced, and rapidly grew to an extensive business: large numbers of vessels were built in different parts of the county. Many of these vessels were used in the mackerel and cod fishery, which in the early part of the present century had grown to an extensive business. The building and use in the county of so many vessels naturally led to the introduction of manufactures of iron.

The forging of anchors and the manufacture of other iron-work for vessels were commenced at an early date, and were prosecuted with success for many years, not only furnishing what was needed for our own vessels, but shipping large quantities to other portions of the country.

Previous to the Revolutionary War the manufacture of guns was commenced, and during the war large quantities of

small-arms and cannon were manufactured for the defence of our country and the security of our liberties.

Here was also built the greater part of the iron-work for those "Yankee cheese-boxes" the monitors, which did so much during the Rebellion to keep our harbors free from rebel pirates.

The manufacture of cotton-gins was commenced many years ago, and is still continued.

The first trip-hammer in New England, if not in America, was constructed and set in motion in East Bridgewater, where was also the first manufactory of edge-tools, including scythes.

History informs us that Archibald Thomson of North Bridgewater (now Brockton) made the first spinning-wheel in this country.

The first machine for making nails and tacks was invented and first used in this county.

The first successful cast-iron plough was invented and made within sight of this hall.

The Dearborn Patent Balance Scale has been manufactured in this town for more than three-fourths of a century.

The manufacture of buckets was commenced here but a few years after the landing of the Pilgrims. The quantity manufactured in this town at one time was so great, that the town was known by the name of "Bucket Town."

Boxes were at one time very extensively manufactured here: undoubtedly the first small wafer-boxes were made by the grandfather of the speaker.

A few years after the Revolutionary War buckets and boxes were exchanged for corn, the price of a bucket or box being its measure in corn: the corn thus received was again exchanged for such articles as were needed for domestic consumption.

In portions of the county the manufacture of boots and shoes has grown to a magnitude sufficient to furnish employment to a very large proportion of the population.

Two of the principal cordage manufactories of New England are located here.

Scattered over the county, and in almost every little village, may be found manufactories of various descriptions.

By the State statistics I find that the value of manufac-

tures of this county during the year 1875 was $20,590,132; and the number of persons employed 9,586 males and 1,629 females, whose wages amounted to $5,324,442, or $474.63 to each male and female: estimating three hundred working-days in the year, it would give $1.58 per day to each person employed.

Turning to the agricultural products of the county, I find their value in 1875 to be $2,124,288. The total amount of wages not being given, I am unable to compare them with those of mechanics.

The number of acres of woodland in the county in 1830 was 35,111; in 1875, 161,275, — an increase of 126,164 acres.

The number of tons of English hay raised in 1830 was 10,921; in 1875, 21,723, — an increase of 10,802 tons.

The agricultural products of the county have changed so much during the past fifty years, there is but little chance for comparison. We have turned our attention from grain and cattle to fruits and vegetables, not on account of the character of the soil or any change in the climate, but because improved facilities for rapid and cheap transportation long distances enable the Western farmer to deliver grain to us at prices so low, that we can pay for it by labor in the workshop more easily than we can produce it from our own soil; and so those who continue to till the soil find it for their interest to cultivate such crops as cannot be easily transported long distances.

A few years of depression in manufacturing business has a tendency to diminish the number of mechanics, and increase the number of farmers. This naturally fills the market with perishable produce, and compels the farmer once more to turn his attention to grain-crops. With improved methods of fertilizing and tilling the soil, and with reduced prices of labor, he finds he is able to compete with the Western farmer.

Plymouth County has a climate and a soil as well adapted to the growth of Indian corn, rye, barley, fruit, and vegetables, as any portion of our country. I say this with a full knowledge that many writers represent the Old Colony as having a climate fit only for the polar bear, and a soil not only rocky and cold, but excessively poor. Our records show that our climate is warmer than the same latitude west of

us. But few counties in the State have less rocks; and, if the soil were cold and poor, it could not be made to produce over a hundred and forty bushels of shelled corn to the acre.

I do not deny that the cultivation of the soil has been very much neglected; but I am unwilling to admit that this neglect is caused by the climate, or sterility of the soil.

Until within a few years our manufactories have increased so rapidly, and the demand for our manufactures has been so great, that our manufacturers have found it necessary to raise the price of labor high enough to draw into their workshops the boys as soon as they were old enough to work, and also young and middle-aged men who were at work in the fields.

In consequence of this, our supply of farmers has been cut off; and our farms have been left to Nature, which soon covers them with bushes, to be rapidly followed with wood, which in time grows to timber.

To the man who fully understands his business, but few if any portions of our country offer greater inducements to the market-gardener or to the producer of milk than Plymouth County.

Good farming-lands which are within from thirty-five to sixty minutes' ride of the city of Boston can be purchased at from ten to twenty-five dollars per acre. This land is well adapted to the growth of small-fruits and vegetables, and, in the towns which border on the ocean, can be cheaply fertilized with the large quantities of rich fertilizing materials that are being continually landed upon the shore, and are within the reach of every farmer in the vicinity; but a few dollars being charged by the owners of the beaches for all that a farmer can carry away during the entire year. This never-failing rich deposit of Nature is of immense advantage to the young farmer of limited means; for, instead of paying out large sums of money for fertilizing materials, he saves his money, and utilizes his spare time and that of his team in improving his farm with the free valuable deposits of Nature.

Being within easy reach of an almost unlimited market, he is able to find a ready sale for the products of his farm. Having purchased his farm at a much less price than the most of those who are now supplying Boston market with

small-fruits and vegetables, and being able to fertilize it much cheaper than they can theirs, the gardener of Plymouth County has the advantage.

In addition to cheap lands and cheap fertilizers, our county stands high in educational facilities, having a well-kept public school in every little village. Free public libraries are scattered over the county; and the numerous church-spires tell of a higher, a religious education.

The schoolhouse, the library, and the church lift the people to a high social position, the advantage of which is probably never so fully realized as when a man takes his family into a Western wilderness, thinking to better their condition.

The time is rapidly approaching when this county will be the garden of the neighboring cities: already the work has commenced; and, as success has crowned the efforts of every intelligent gardener, our waste lands will soon become gardens.

Taking this view of our county, I am glad that the Board has consented to come among us to enlighten us upon subjects which so deeply concern our welfare.

I trust that the advanced ideas that may be promulgated at this meeting may not fall on barren soil, but that they may reach minds able to comprehend their value, and to realize the importance of putting them into practical use.

Capt. John B. Moore of Concord was then introduced, who read the following paper: —

ROOT AND VEGETABLE CULTURE.

BY JOHN B. MOORE.

Mr. President and Gentlemen, — The secretary of this Board informed me by letter that I had been selected to present the subject of root and vegetable culture for your consideration, and blandly added, "Tell them what you know about it." If he had said, "Tell them how little you know upon this subject, and then stop," no doubt I could have made this paper somewhat shorter.

But this brings to my mind the fact of how little we know about many phases of plant-growth, and what a vast field

there is still to be investigated, and the great amount of knowledge we can get, and the good that may result to the farming community, by such investigations, provided that they can be practically applied in the every-day operations on our farms.

What the farmer, who by his labor on his land supports his family and educates his children, wants to know is, how to prepare his land, manure it, plant it, cultivate and harvest the crop, so as to get the largest return at the least expense. That is practical knowledge; that is something tangible, one can feel it in his pocket; that is what the farmers want to know: and I may be allowed to speak for them, as I am one of their number.

And when I say that the farmer wants more practical and less theoretical teaching, from the college down to the newspapers, I but echo the opinions of the best farmers in the country.

The first thing to be done by a person intending to grow a crop of roots or vegetables is to select a proper piece of land that has a soil adapted to the crop intended to be grown. As an illustration, you should not expect to succeed perfectly, if you planted onions, cabbages, mangel-wurzel, and some other crops, on a light, sandy soil; or carrots, parsnips, rutabagas, on a heavy, wet soil. There might be a partial crop, but not a success. Therefore adaptation of the soil to the crop is the first essential thing. This the grower must from his experience decide for himself. The next is the preparation of the soil. There are two things in the preparation of a piece of land to fit it to grow a crop: one is the fertilizer, or plant-food, to be applied so as to give the plant the requisite nourishment to perfect its root, tuber, or seed; the other, the working or mechanical preparation of the soil before the planting of the seed.

Now, then, a full success will depend not only on the quantity of manure applied, but on its particular composition, and its adaptation to the crop to be grown. Eminent chemists have clearly demonstrated that all plants require certain elements of plant-growth: among these are nitrogen, phosphoric acid, and potash, they being the principal ones; also some others which do not appear to be of that importance practically considered, as they are usually found in

sufficient quantities in Massachusetts soils for all the wants of plants.

Now, the different species of plants require these important elements in quite different degrees or quantities: that is, one kind of plant will require nitrogen in large quantities; another, phosphoric acid; another, potash; and it will be found that almost all cultivated plants will require one or the other of these three things largely in excess of the other two.

Now, if it is true that the crop to be grown will in quantity and quality, to a large extent, depend upon the adaptation of the manure to the particular variety of plant, as well as on the quantity applied to the land, it will be proper to inquire how a farmer, with his limited amount of knowledge of the wants of plants, would be able to make the most judicious combination of manure to grow the various species of plants.

Shall he avail himself of the knowledge acquired by eminent chemists who have made researches as to the plant-food required by most plants by repeated analyses of what the whole plant contains? In answer, I should say, Yes.

What can the chemist tell us about plants? Why, he can tell us nearly this, — how much nitrogen, how much phosphoric acid, how much potash, a crop of so many bushels to the acre — with its stalks, leaves, and roots — contains, by an analysis of such crop. He cannot tell how much nitrogen comes from the air, and how much from the soil in which the crop grew. He will hardly undertake to say that a plant does not receive a larger amount of nitrogen during certain conditions of the atmosphere than in others.

The chemist can also tell us the value of and the sources from which we can get certain materials to supply nitrogen, potash, and phosphoric acid in the best and cheapest form, other than barnyard-manure; for, unless they can be procured in a cheap form, they would not be desirable. And here let me say that I feel under great obligations to Professor Goessmann and to Dr. Nichols for information, at various times, touching these very matters of supplying plant-food to crops; and the readiness to impart any information upon these subjects which they possess is commendable, and deserving the gratitude of the farming community.

Now, then, for the application of this to the subject under consideration. How shall we adapt the manure so as to supply the wants of the plants to be grown? In answer to this, I would adopt the following method, as a general rule, to be applied to all farm-crops. We have the wastes of the farm, — the animal excrements from the stable, barnyard, and pig-pens. As the first sources of supply, these are to be applied to your land in good, liberal quantities, if you desire large crops; and this is not all that is necessary in the way of manure to grow roots or vegetables with the best success, as this application alone does not supply one of the particular elements in such quantities as may be needed by the plant: therefore let us add this particular element in some form, which would usually be in a concentrated one.

I will illustrate it in this way, — suppose the crop is to be onions: give the land a liberal dressing of stable-manure. That is not all. Chemists will tell you that onions want more potash than is supplied by the manure. A long experience has convinced the growers of onions of the same thing; for they have found that a dressing of wood-ashes is one of the best applications for this crop: therefore, if this is true, we have to come to the conclusion that onions want a larger supply of potash than they will ordinarily receive from barnyard-manure, and potash must be supplied in some form to meet the wants of this crop.

I have found the following a good practice on my farm; and I do not, after an experience of a few years, see any good reason to change it: First to manure my land with a dressing of stable-manure, and then to add a quantity (such as in my judgment would be sufficient) of one of the three elements before named for the particular crop which I intend to grow. Having provided the manure, prepare the land further by a suitable ploughing, followed by thorough pulverization of the soil, so as to reduce it to as fine tilth as possible; and by this very operation the manure which has been applied becomes intimately mixed and subdivided.

This is on the assumption that the manure is not to be applied in the hill, but broadcast, which is, as a rule, the best.

The land has been manured, ploughed, and harrowed, and is nearly ready for the seed: if that is to be sown on a level surface, it only wants smoothing as a finish; if on ridges,

they can be made at any distance apart by turning two furrows together, and levelling off the tops of the ridges. Plants like mangel-wurzel and carrots grow better or larger on ridges than on level land, particularly on moist soils; and this would apply to old, rather than to sod ground.

An intelligent cultivator will see at once that these directions will be subject to considerable variations, for the reason that some crops will be better sown on a level surface, some on ridges, and some in raised beds. All this should be provided for by the judgment and experience of the owner.

We now come to seed and its planting. Pure seed and good seed — this is not exactly a myth, but is not as common as it ought to be. We may buy pure seed, and still it may be so old that it will not vegetate; and, if so, it would not be good pure seed.

By pure seed, I mean pure in the common acceptation of the term as applied to improved breeds of cattle or vegetables, and not as a pure type of the original species. To have good seed is an important matter, for without it the crop fails; or, if from impure or badly-bred stock, it may be comparatively worthless except for cattle-feeding. Therefore, if the crop is intended for market or for family consumption, the seed of a variety adapted to the market, that will produce handsome, well-shaped, edible specimens, is the only kind a person should be satisfied with.

Perhaps for stock-feeding, where a large product to the acre is desirable, a certain degree of coarseness might be permitted, although smooth, well-grown specimens would probably be better in quality.

It would not be in place here to go into a long essay attempting to show how to produce the best seeds. But the difficulty we all have to encounter in procuring good seed, even from the most honest and reliable seedsmen (and I think we have such men), makes it proper to suggest to farmers who may happen to have a very good variety of roots or vegetables, to keep a quantity to propagate seed sufficient for their own use. Now, to do this successfully, great care must be exercised in the selection of the stock intended for that purpose. And the person making the selection must have an ideal in his mind of the exact thing he wants to perpetuate; and that should be of the highest standard. And this

ideal in a person's mind is something that one cannot impart to another person. Now, this is all right so far as some vegetables are concerned, — for instance, onions, carrots, beets, and all other plants where the seeds are propagated from roots grown the previous season with a proper selection, — because there has been a provision made for the male as well as the female, so that the flower of the plant may not be crossed by an inferior male.

But how is it with corn, and many other plants that produce their seed the first year? Take corn as an illustration. A person following the directions generally approved goes into his field, and selects his seed-corn from the earliest and best ears, and thinks he has done the best thing: his seed would be probably a little better than an average of his whole crop.

What provision has been made for the male? Is not the seed just as likely to be crossed with a poor or inferior male as with any thing else? It seems to me that it is. Now, let us go one step farther. Suppose some one with an ideal in his mind of what the best corn should be, both in the stalk and the grain, should go into the field before the pollen is matured, and cut out all the male organs not answering to his ideal, then you have provided for the sire; and then we shall secure a better standard than now.

A gentleman here in Hingham, whom I regard as the best authority on vegetables in the country, recently told me, that, in talking to farmers about seeds, he advised them not to set too high a standard, saying that was where he had failed. I have thought of his remark carefully, and must say that I can see only one correct standard.

Now, the same care and skill that one would use, were he attempting to breed a fine animal, is requisite in breeding seed, remembering that the principle that like produces like is as surely correct in the vegetable as in the animal kingdom.

Having procured the seed, the next thing to be done is the planting. There is such a diversity of crops, and the distance apart of the plants and of the rows, and the depth which the seed should be planted, vary so much, that I will not undertake to state any particular, but only a few general rules.

First, Have straight rows of a uniform distance apart.

Second, Seeds should be planted in depth somewhat in proportion to the size of seed itself; that is, the smaller the seed, the less depth it should be planted: in fact, many of the small seeds germinate better by planting very shallow, and then compacting the surface of the ground with a light roller.

We then come to the cultivation of the crop, this having been planted properly in straight rows and at a uniform distance apart; and that distance, for most of the field-crops, should be sufficient to admit between the rows a horse and plough, if the seed has been planted on ridges, by which a skilful ploughman can with his plough cut away the sides of the ridges, and can kill all the weeds between the rows, and which, after laying a short time, can be turned back, making them complete again; or, if the seed has been planted on a level surface, he can stir the soil and kill the weeds with a cultivator in the same way.

I hardly need to say that a thorough working of the soil and a substantial freedom from weeds are now the important things to be attended to. Working the soil between the rows frequently, oftentimes prevents the injurious effects of a drought, and at the same time destroys the weeds, which would shade and smother the plants, and would also rob the soil of the moisture and nutriment intended for its support.

Many varieties of plants suffer very much from being overrun with weeds when small: the carrot is one of the varieties which is sometimes almost ruined by not being weeded in season.

A war of extermination is perfectly justifiable, and is the proper course, with weeds.

Now, Mr. President, I have discussed this subject in a general way, and, I fear, imperfectly, under the following heads: —

1st, The selection of the land.

2d, The adaptation of the same to the crop.

3d, The preparation of the soil, including the manuring.

4th, The seed.

5th, The after-cultivation.

And I found, when I first examined this subject, that I must take it up somewhat in the order I have named, and give my reasons as I progressed, even at the risk of becom-

ing tedious; and I venture to express the opinion that a large, full crop of roots or vegetables cannot be grown unless those conditions, under the heads I have named, are substantially complied with.

And now I will state what, in my short experience, has proved with me to be the best methods of procedure in raising certain crops. Potatoes — to produce a large crop of fine potatoes, select a piece of grass-land, with a soil adapted to this root; upon this grass-land, in the spring of the year, spread a good liberal dressing of coarse stable or barnyard manure; then plough the land, not exceeding four inches or four inches and a half deep, turning the sod flat; upon the inverted sod sow broadcast such a quantity of dissolved bone and potash as in your judgment would supply the wants of the potato, which it would not be able to get from the manure applied; then thoroughly work and pulverize the inverted sod with a Randall or Shares harrow; furrow lightly, so as not to tear up the sod, three feet and a half apart one way only; drop your potatoes a foot apart in the row, and cover two or three inches deep. Now, the condition of the land planted is precisely this, beginning at the bottom: first, we find a layer of soil over the subsoil four to six inches deep, then on this a layer of coarse stable-manure, then an inverted sod, composed largely of stubble and roots, containing a large amount of vegetable matter four inches thick, the upper three inches of which have been well pulverized. The soil under the manure will absorb any fertilizing matter inclined to go down. The manure and sod are so near the surface as to be readily under the influence of the heat from the sun, and moisture from rains and dews, which cause a rapid decomposition of the sod and manure, and convert them into plant-food, furnishing an abundance of material to feed the crop; and the potato itself finds a bed for its tubers in the loose sod hardly to be had in any other condition of the soil.

The vigor with which potatoes start under this treatment suggests bottom-heat.

I would further say that this is the cheapest and most perfect method of composting manure that I know of.

Asparagus was grown in the town of Concord, where I live, to a large extent for Boston market.

To compete with the skilful growers who were then supplying that market, it was necessary to reduce the cost of production to the lowest point possible, and still grow a good article.

The first thing, as in all other crops, was to select a piece of land adapted to this plant. In my judgment a warm, sandy loam is the best.

The land should be ploughed one or two years previous, so as to have no sods in the way to obstruct operations.

The next thing was to substitute horse-power, wherever it could be done, for manual labor.

We do away with all the trenching of the soil two or more feet deep, or the still older English method of paving the bottoms of the beds with flat stones to prevent the roots of the plant from running down. I could never see any need of paving, as the habit of the plant is to extend its roots laterally.

These methods of preparation involved a large expense. The trenching alone would cost about a dollar a square rod, or $160 an acre.

Now, instead of trenching, we plough the land from sixteen to eighteen inches deep, which is enough for all practical purposes. This we do with a strong team and a strong plough. The first one or two furrows will require the team to go in the same furrows two or three times, so as to get the full depth; and, after once getting the full depth, there will be no difficulty found in drawing the plough with four good oxen or horses, provided you take narrow furrows; and that would make the best work.

Now let us see how we stand in the outset. The operation of trenching would cost $160, of ploughing, not over $8, an acre, — a saving of $152 an acre. I am prepared to say it is as good as, if not better than, the trenching.

The next thing to be done is to cart on to the land, and drop in heaps, the manure. The usual application is not over eight cords to the acre, and is probably as much as would be economical to apply the first year, as the plants are not established, and could not use any more if it were in the soil. Spread the manure, and plough it in with a one-horse plough, after which harrow and level the ground.

Now mark the rows at the ends by measure, three feet

and a half or four feet, or whatever distance you may decide to have the rows, apart, setting a stake at each end as a guide to drive the horse to; open the furrows by going down and back in the same furrow: when going back in the same furrow, a skilful ploughman will straighten any little crooks. This will leave the land in ridges. The furrows are to be cleaned out level at the bottom the width of a shovel, and at as near a uniform depth as possible; and that depth should be eight inches below the level of the original surface of the land.

The piece is now ready for planting. A man steps into the furrow, and sets the plants, usually a year old, from twelve to fifteen inches apart, as the owner may decide, placing the crown up, and carefully spreading the roots out on each side, and at the same time covering them with his hands two inches deep, which can readily be done, with soil from the sides of the trench.

The bed is now planted. The after-cultivation will be to hoe the plant, which will soon come up, taking the dirt from the ridge in between the rows, and gradually filling the trench: this will have to be repeated as often as the weeds start, until towards August, when the trenches will be about full; then a horse and cultivator can be used the rest of the season. The course I pursue on an established bed is this, commencing after we have done cutting for the season: —

Go through the rows with a horse and cultivator as long as the tops will permit a horse to pass through without too much breaking; hand weed once after this if necessary, then, some time the last of October or in November, cut the tops, and burn them on the ground; plough the whole bed five or six inches deep, which will not injure the plants if they have been carefully set as I have described: this completes all for the autumn. In spring go over the land with a Randall harrow; apply the manure; work again with a Randall harrow, and finish it off by using a common harrow; now let it lie until the plants are about starting; then go over the piece with a brush harrow, which will kill all small weeds, and save labor.

The crop, like all other products sent to market, must be properly packed, and sent to market in the best shape and condition, to realize the best prices.

To learn this, it is best to visit some grower, and see the actual operations performed, as some of them would be difficult to describe here.

The CHAIRMAN. The subject is now open for discussion.

Mr. SLADE. Do you plant whole potatoes, or do you cut them? You did not tell us about that.

Capt. MOORE. I usually cut mine. I have never experimented enough to know whether a whole potato or a piece of a potato, one end of a potato or the other end of a potato, is the best. I do not undertake to tell you any thing I don't believe I am correct in; and I will not undertake to express an opinion upon that, because I don't think I could give an opinion that would be worth more than the opinion of any other farmer here.

Mr. WHITAKER (of Needham). Where you have several sprouts on a potato, will not one or two of those sprouts be very likely, on level lands, to take the lead, and the others die out?

Capt. MOORE. I think that is so. And I will state another thing, because I have noticed it a great many times. You can go into a field; and, where you find one or two stalks very large and vigorous, there is where you will get the biggest and smoothest potatoes always, if you want to carry them to a cattle-show.

Mr. WHITAKER. Do you not suppose, that, as a general thing, flat culture is the best, not only for roots, but for other products?

Capt. MOORE. I have just stated, that, on wet soil, I think it would not be.

Mr. WHITAKER. But on the generality of soil?

Capt. MOORE. I think mangel-wurzel will grow a great deal larger on ridges.

Mr. WHITAKER. The largest mangel-wurzels that I ever raised were planted flat on a gravelly knoll.

Capt. MOORE. That was because of the condition of your land. If it was a gravelly knoll, you must plant them flat, or the plants would all dry up. I usually select rather moist, wet soil for mangels, where I have grown more than sixty-five tons to the acre.

Mr. WHITAKER. I have seen cultivators of mangels and

ruta-bagas that would open a furrow, and put the manure in the furrow, and then go round with the plough and turn the soil on to that, and plant on top.

Capt. MOORE. Yes, that is very often done.

Mr. WHITAKER. Would you recommend that?

Capt. MOORE. If I had an abundance of manure, I should rather spread it on the whole field, and plough it in. I suppose that is one way of applying the manure more directly to the crop. But in ploughing it in, and ridging up a piece for mangel-wurzel, you have it all in the ridges. Many people put a pile of manure around the trunk of an apple-tree, and think they have done the best thing, when the feeding-roots are ten feet from there.

Mr. WHITAKER. Don't you think the best means of applying manure for all crops is to apply it broadcast?

Capt. MOORE. I have said in this paper I thought it was, as a general rule.

Mr. WHITAKER. Well, exceptions prove the rule.

Capt. MOORE. I grow sweet melons quite largely for the market; and I should never manure them in the hill, except for the purpose of giving them a little start. Some of our squashes grow better without any manure in the hill, except something just to start the plant.

Mr. WHITAKER. A little guano?

Capt. MOORE. Any thing that will give it a rapid start.

Mr. WHITAKER. What time would you consider the best time for planting squash-seed?

Capt. MOORE. When you talk of planting squashes as a field-crop, of course the product is sold in the market. It would depend somewhat upon whether you were going to store those squashes for winter. You would undoubtedly grow a larger crop if they were not planted until June. Cultivators seem to think that the crop escapes the maggot a little more when planted late than when planted early, and escapes the ravages of the bug somewhat more planted late than early; and our squashes, like the Marrow and the Hubbard, have ample time to ripen then.

Mr. WHITAKER. I have not been successful with squashes; and some of my neighbors said I planted too early, — I should not plant before the 10th of June. This year I planted on the 15th, and lost most of the squashes. I don't know

what the reason was. They said I planted them too early,— I should not have planted them before the 20th. I want to see if I can't get it down to the 1st of July.

Capt. Moore. I lost my early ones; but, from some planted late, I got a good crop. There are two kinds of maggot that attack the squash, and it is very hard to get rid of them. One is a small white maggot that eats the roots: you pull up a plant where they are at work, and you will find that they have riddled the bottom roots. The other is a maggot about half an inch long, and as large round, perhaps, as a pipe-stem. It generally commences on the stem, at the surface of the ground, and eats up the stem two or three feet. I think that maggot comes out of the ground. Some people have got the hang of them so that they can go along with a penknife, and take them out without injuring the squash, if they do it in season. Where the roots are destroyed, the plant will in many cases, if the ground is rich, strike out roots from the joints. I have seen good crops of squashes grown where the original roots were all gone. I would not, however, suggest cutting off the original roots for the purpose of securing a crop. That is the way we account for squash-vines running ten feet sometimes, and then turning yellow, and dying. It is usually owing to one or the other of these maggots. I do not know the habits of the miller or fly that deposits the eggs, well enough to describe them.

Mr. Flint. Dr. Fisher will talk on that special subject.

Mr. Hadwen (of Worcester). Capt. Moore introduced one subject in which I was very much interested, and, I have no doubt, many other farmers; and that is, in relation to growing pure seed. I would like to have the captain enlarge upon that subject a little, and would inquire if he has grown any other seeds but corn on scientific principles, or any principles which will give value to the seed, and give value to the plant.

Capt. Moore. I have experimented somewhat with various kinds of seeds. I grow my own onion-seed, and for that I select my onions myself. It will not do to trust that to one of your men. You must have a pattern in your own mind of exactly what you want, and you cannot describe it to a man. You may give him an onion, and tell him that is a specimen of the kind you want, and he cannot get one just

like it. I don't know why it is, but it is no use: you have got to do it yourself. If you want to make any improvements, gentlemen, in my judgment you have got to find the brains. You cannot hire an Irishman and find brains for him; or, if you do, the brains are not worth having. You must do it yourself.

Mr. HADWEN. I have heard of the brain impression in breeding animals, and I have just begun to see where the brain impression in growing seed comes in.

Capt. MOORE. I can say something more in regard to the importance of pure and good seed. I grow onions pretty largely. This year I wanted to sow an acre more than I had done before; and as I had grown seed sufficient for my own use only, as I did not care much about growing any more than I wanted, I found, when I came to plant that acre, that I had not seed enough. I went to Boston, and bought the best seed I could find. I bought the Buxton seed, which stands as high in the market as any other seed. The quality of the onions that grew was good; but either because the seed had been tampered with, or for some other reason, although it was sowed at the same time, with the same machine, the same quantity per acre, and on land of the same character, I did not get more than quarter as many onions on that acre as I did from my own seed. Something was the matter. Perhaps the seed had been badly cured. A seedsman told me the other day that it was pretty hard to throw seed away that they had paid seventy-five cents a pound for. Perhaps they gave me all good seed; but it involved a very heavy loss to me not to have that seed come up. That is one reason why I say, if you have a good variety of any vegetable, use your own brains, and raise seed enough for your own use, and be independent of the seedsmen, as far as you can.

Mr. SLADE. Was that seed sown on land that had been planted to onions before?

Capt. MOORE. Yes, sir; but there was a marked difference. I do not know why that seed, if it was grown last year, should not have vegetated just as well as my own. I could see no reason. The seed looked well enough; but it didn't grow. That was all there was about that.

Mr. PETERSON (of Marshfield). Is not onion-seed more

likely to injure by exposure to the air, even for one year?

Capt. MOORE. All mine grows, if it is only one year old.

Mr. PETERSON. Do you keep it confined in paper?

Capt. MOORE. I keep it in boxes or barrels, or something of that kind. I have no trouble with my own seed. I don't want you to understand that I say that either Mr. Buxton or the seedsmen had tampered with that seed; but it did not grow. I don't know why. I only say that Mr. Buxton's seed is as good seed as any in the market. There is no seed I would buy quicker, if I wanted to buy it.

Mr. HADWEN. Will Capt. Moore tell us in regard to asparagus-seed?

Capt. MOORE. I was probably the first man who grew asparagus for the Boston market. I wanted to grow something that I could get some money for, and something that I could transport to Boston easily, and that would not injure in transportation: so I thought I would try asparagus. Asparagus was then largely grown in beds, and it was forked over. My object was, in the first place, to grow a good article at a low price: therefore the first thing was to substitute horse-labor for manual labor. This was one of the reasons for planting to the depths I mentioned in the paper. If I were going to plant merely for family use, I doubt if I should plant it so deep as that, because the difference of an inch in depth makes a difference of a day or two in coming. I do not think, that, in cultivating it for market, a day or two makes much difference, because an asparagus-bed will grow just about so many bunches, and, if picked very early, the market is filled from New York and other places, and you will not get as much money for it as you will if it is picked later. Taking one year with another, asparagus brings more the last week in May and the first week in June than at any other time. It is no great object, therefore, to get it very early; and, as I said before, a bed will produce only about so much without injury to the bed. When a bed shows signs of exhaustion, you had better stop cutting it: otherwise, you will find the bed will play out pretty quick, as I have known a good many to do.

Mr. PAUL (of Dighton). What are the evidences of exhaustion?

Capt. Moore. Running small. When you see that indication, you had better stop cutting, or else you will take all you cut of your next crop three times over. If you go on cutting it away up into July, as I have known some of my neighbors to do, you will kill the goose in getting the golden egg. You will not get any next year to pay for it.

As I said, when I first began to grow asparagus, I happened to know of one particular plant that grew enormous asparagus, and I got seed from that plant. Most of the stock in the vicinity of Concord has come from plants procured from my place, or from seed from that plant, and there is great uniformity in it: I mean previous to the introduction of what is called "Conover's Colossal," which has since come into the market.

Now, in regard to saving seed: my custom has been, of course, to select the seed from the largest and best stalks in the bed; and, just as when people select their corn without any reference to the male, that seed would, of course, be better than the average seed of the bed, because it came really from a good female: the mother was a vigorous plant. But two years ago I was thinking the matter over, and I made up my mind, as I was going to set out a couple of acres of asparagus (which I shall do next spring), that I wanted something a little better than I had. How was I going to get it? There was no better stock to get it from than I had myself: I was satisfied of that. How was I going to get something a little better? I knew this fact, — that in my bed there were a number of plants that uniformly every year grew large stalks, as big as a hoe-handle when they came up. Among those plants there would be some that would give green tops, and some light green: there would be variety in the tops in color. The market wants purple-topped asparagus. I wanted to propagate something that would meet the demand of the market: so I began last year, and every day, as the stalks came up, I put a stake down where I found a stalk that came up exactly to what I wanted. I had formed an ideal in my own mind, and I did not trust any one else to select the stalks. I put a stake by that stalk in order to provide that it should not be cut.

After the stalks got a little higher, I put bean-poles in the field, so that I should know those stalks in the fall. I

allowed them to run up, while all the rest of the bed was cut, until about the 15th or 20th of June. The result was, that those plants had run up and blossomed, and set their fruit, before the other plants in the bed had blossomed at all. Now, I would like to know if I have not provided for the male. They could not be crossed except by the best plants I had in the bed. There was no possibility of any thing else crossing them: therefore that seed was all crossed from pollen of large stalks of the same kind. You will see that at once. Perhaps you will say that the plants will not be any better: still I have faith that they will be. I had so much faith, that I put off planting my asparagus-bed to get plants in that way. Last spring I planted the seed on ordinary ground, manured no better than any one else would manure it; and two or three of my neighbors, who have been growing asparagus for their own use, wondered how I got such great plants there. Mr. Hubbard's plants were up in rows, so that I could see them, before my seed was sowed; but mine grew two or three feet higher than his, notwithstanding his had a longer season of growth. Asparagus will grow as long as the weather is warm. Many of my stalks are as big round as a pipe-stem: that is pretty good growth for the first year. I am going to plant two acres with that kind of stock. You may think the asparagus will not be any better; but I think it will be. I think I have, by pursuing that course, provided for the male; and that is what I want you to do with corn.

Mr. COMINS (of North Hadley). Have you practised that method for growing seed-corn?

Capt. MOORE. No, sir, I have not: I was talking of principles. I will say, further, that I grow but very little corn. There is nothing handsomer than a good field of corn that a man can grow, and, if I were located where I could not grow something else to better advantage, I would grow corn; but in my case I cannot see my way to grow corn. If I had a great deal of stock on my farm, and wanted manure, and had poor land that would not grow grass, it might be an object to grow corn for the sake of the corn-fodder, although I think the enthusiastic corn-men rate corn-fodder for all it is worth, — more than my cattle do. They set it a great deal higher than my cows do. But they are reasonable and

intellectual beings, and they ought to know more than a cow, perhaps.

Mr. Comins. I can see some difficulties which I think may arise from growing seed-corn in the manner suggested by Capt. Moore. My own time for selecting seed-corn is at husking. I can select better ears then than I can if I go into the field when the corn is growing, and pick out the best stalks. If it is cut up, as we practise cutting up our corn, the ears will ripen better than they will if picked from the stalk, traced, and hung up. I am inclined to think, if this mode of selecting seed-corn were carried out, there would be a good many imperfect ears in the field: there would be a good many female or pistillate organs that would not be fertilized, and we should get a large quantity of imperfect ears. I do not believe in taking seed-corn, or any other seed, from imperfect specimens. I am very careful about that thing. I have raised some corn for seven or eight years; and I always select my seed-corn, growing it on the same land, and I find my corn has very materially improved from what it was. But I think if any farmer should cut off the spindles from the weak stalks in any field of corn, for the sake of getting perfect ears, he would find a large proportion of the stalks were imperfect, and consequently a large proportion of the ears selected would be imperfect. I may not be correct; but I have that impression.

Mr. Whitaker. I like what Capt. Moore has said about having an ideal in your mind of whatever you want to do. I used to be acquainted with an old gentleman who used to say to me, "Whitaker, it's no use trying to get any thing out of a man, unless he has the thing in him to begin with." He used to say a man could never make a plough, unless the plough was in him; that he could never make a shoe, unless the shoe was in him. We hear a great deal said at times about the imagination. Well, there is a use, a legitimate one, for the imagination, as there is for every thing else. There was never a man in this world who produced a machine, who did not have that machine formed on his brain before it was placed on paper, or constructed in wood or iron. The machine was developed in his mind, and all he had to do was to go to work and copy that image in his mind. Now it must be the same with farmers. They are the most

scientific class of men there is, if they only knew it; and they are certainly the most artistic. We admire a man who can paint a fine horse or a fine cow; we say he is an artist and a genius: and we admire the man who can take a chisel and hew out a cow, a horse, or a man, and we look at the statue with wonder: we are suprised to think that any man could make such an animal as that out of stone. Now, Mr. Chairman, here is the breeder of the cow, of the pig, of the sheep, or whatever animal you want to breed. That man has that animal pictured in his mind: it is his ideal; and he goes to work to produce it, has succeeded in producing it, and will do better things yet; and, when he has done that, he has made it, not out of stone, nor put it on canvas, but he has made it out of flesh and blood, and he has endowed that animal with the property of transmitting its own form, its own shape, its own color, to its progeny.

No one of you would buy an Essex pig of me, if there were any white hairs on it: you would demand that it should be perfectly black. If I had some Berkshire pigs, and you came to my place to buy them, and did not find the white snout, the white toes, and a little white spot on the shoulder, you would say they were not pure bred: so it is with every other class of animals. Now, what class of men is there that stands higher in an artistic point of view than the agriculturists? Capt. Moore is a very modest man. He says he does not want to be understood as farming on scientific principles. I have been wondering how he was going to get out of it, — which way he would turn to get away from that science which underlies the whole thing. I believe he has got at the bottom of the matter in regard to corn. You have got to have an ideal in your own mind of what you want, and you cannot impart that ideal to any other man, because it is the fruit of your own brain, and not of another man's brain, and you have got to make an exact picture on another man's brain and another man's imagination, before you can get that man to obtain it for you. But Capt. Moore goes to work himself; and he gets the onion he wants, and he gets asparagus of the color and size he wants. He says he has not reduced it to practice; but he gives a system for getting seed-corn which I venture to say is the right one. Now, he may have his eighth of an acre just for the purpose of

getting seed, and he goes to work and cuts off all the spindles of those ears that he does not want to bear. He may have some to begin with that may not be perfectly developed, and others may be developed according to the ideal he has formed in his mind. He does not want those ears that are not developed, and he would throw away all that were not filled out to the very tip. If the corn did not correspond to the picture in his mind, he would reject it, and try again. All these things have to be worked out. But the great thing is to have the idea first in our own minds; and we often fail, because we do not have a distinct idea of what we want, to begin with. We begin, as it were, at random, and our results are like random shots.

Now I think, if Mr. Moore never gives us any other idea, he has done a great deal to-day in telling us that we must have this ideal; and it seems to me that is necessary in all our efforts. If we are only going to hoe a field of potatoes, we want to know what that field of potatoes will look like when we have hoed it; and we ought not to begin to hoe it unless we have in our minds what it is going to look like when it is done.

Mr. HADWEN. The sound and practical reasons for seed-growing which have been set forth in the essay are hardly open to any criticism which I can conceive of. The captain seems to have studied, and to understand his subject so well, and is so far ahead of the majority of us farmers, that I think the paper has been very instructive, and will be useful hereafter. He speaks of the breeding of animals and the breeding of seeds as growing out of the same principles; and there is no doubt that the same attention given to each of those departments will produce the same results. We can produce better seed by careful culture than we can by hap-hazard culture; but there are other conditions which always come in, both in vegetable and animal growth, which have to be conformed to. Uniform care and cultivation are absolutely necessary in each. No one would expect to raise good, uniform corn, merely from a good selection of seed: the cultivation must be equal: it is so with the feeding of stock. No man can breed uniform stock without uniform care: these conditions are as important as is breeding. Now, the captain has told us one of the principles in the

breeding of seed, if I may use that term, that "like produces like." But the great difficulty with the animal is to get two that are alike: that is what bothers the breeders, and must. Of course, we know that no two things can be exactly alike; but to get them as nearly alike as possible is a very difficult thing in animal breeding, and it must be so in breeding seeds, to a certain extent; and, in breeding seeds with any care, another important element is proper and judicious selection. Now, I have paid very little personal attention to breeding seeds; but I think I comprehend the principles which the captain has given us this morning, and have tried, to a certain extent, to carry them out. I made, this last season, a little experiment with carrot-seed. I found great difficulty in buying seed by the use of which I could grow carrots with uniformity. I want a carrot of a certain type, — not a long carrot, but a carrot which will weigh heavily, a carrot which will be nearly as large at the small end as at the big end, to use a common expression. I made a selection, last spring, of carrots for seed, and set out those which seemed to be the type which was in my mind that I would like to have throughout a field; but I have not yet carried the experiment far enough to reach results. Next season I shall plant that seed, and observe the results. Of course I do not understand all about the male and female parts of the carrot; but I know there are probably male flowers and female flowers of the same plant, and I believe that the captain has given us to understand that those plants must be cross-fertilized (self-fertilization I believe he does not approve of); but this fertilization is a good deal of a mystery to the common farmer, and probably will remain so for some time.

Capt. MOORE. I would like to say one thing, which perhaps I did not make quite clear, which Mr. Hadwen brings to my mind; that is, it is perfectly apparent to any one who has watched carefully the breeding of corn, that the same stalk of corn does not like to fertilize itself. That has been apparent to me for a great while, and I think there cannot be a farmer in this room who has not noticed it and in this way. Perhaps he has a field of potatoes, with no corn anywhere near it: a stalk of corn comes up in that field, as we have seen a great many times, grows vigorously, and he thinks

he is going to have big corn there; but, when he comes to husk it, he finds there is no corn on that ear. It only shows that Darwin's idea is true, — that self-fertilization of some vegetables and some plants is rather abhorrent to the plant.

In answer to the remark of the gentleman [Mr. Comins], that he should be afraid, that, by cutting out the stalks, he would get a good many small ears of corn, I will say, of course I meant to have it understood, that when ears were selected out of that field, just as Mr. Whitaker said, there would be a great many of them rejected. If you are growing seed-corn in that way, you must always expect to get more or less small, imperfect ears; and if you cut open a stalk of that corn, and examine it carefully with a microscope, you will find a number of undeveloped ears of corn in there, which the plant had not the power to develop. That accounts for some of the small ears. The plant has developed all that it is able to carry.

Mr. LIVERMORE (of Middleborough). I will say one word in reference to the question of growing roots nearly as large at the bottom as at the top. I knew an English gentleman who had cultivated roots in England extensively; and he accomplished the object perfectly that Mr. Hadwen desires, by running the plough shallow, so that the roots should not run deep. He fertilized the soil well, mellowed it well, but was careful not to mellow it deep.

Mr. FLINT. I would like to make a single remark in reply to what Mr. Comins has stated as an objection to making a selection of seed-corn as Capt. Moore has recommended. His objection is, that if we should go round, and cut off all the tassels of the stalks which appeared to be imperfect, there would not be fertilizing material enough, or pollen enough, to make sure of fertilizing all the germs to form a perfect ear. In reply to that, it seems to me it is sufficient to consider that Nature is wonderfully prolific throughout. You see it everywhere. Every farmer knows, that, when he strikes his scythe into a field of Timothy when it is in blossom, the air is full: there is a perfect cloud of fertilizing or dust pollen. There, you see, is an amount of material which passes all conception, coming from the male organs of the plant. The amount of pollen produced by our higher plants is enormous. Now, the point was this, — that supposing the

weak spindles were cut away from a considerable number of stalks on this eighth of an acre to which Capt. Moore has alluded; and supposing you cut out the suckers which will sometimes come up, not to perfect ears, but to perfect their spindles (you frequently see suckers coming up which spindle out, and, although they cannot perfect ears, those spindles from a sucker or a weak plant can fertilize the pistils of a plant, so that, if the pollen from the spindles on a sucker reached the germ, it would be the only pollen that would fertilize that germ); supposing, I say, that you should cut out all the weak plants, those that were unsatisfactory, that failed to come up to your idea so far as strength and vigor and earliness were concerned; supposing, also, you cut off all the suckers, thus preventing them from spindling out, and furnishing pollen, — there would still be sufficient plants left to furnish pollen enough to fertilize all the ears that could be grown on that eighth of an acre, and a million more ears; so that I do not think that the objection which Mr. Comins has made to selecting seed-corn in that way is a valid one. I am inclined to think that the method of selection suggested by Capt. Moore is vastly superior, so far as the perfection of breeding is concerned, to the method pursued by Mr. Comins. Mr. Comins is a successful farmer in the Connecticut Valley, — a farmer who grows first-rate corn; and he says that his corn has improved from year to year. I have no doubt of it. He has cultivated it intelligently and well. But that does not prove that his method of selecting is so good as the more careful and scientific method suggested by Capt. Moore. If Mr. Comins should set apart a small portion of his corn-field of five or ten acres, say an eighth or a quarter of an acre, and take particular care to see that the seeds on that eighth or quarter of an acre are bred in this careful manner, I am inclined to think that he himself would come to the conclusion, in five years, that he had reached a better result than by his own method. The difficulty in selecting seed at the time of husking is that you cannot tell where the male fertilizing material has come from. Your seed may, perhaps, be taken from an ear that was perfect; but you do not know with any sort of certainty that the seed from that ear is going to produce such an ear as the ear from which it was taken. If it was fertilized by a strong

and vigorous stalk, you may get as good an ear as the ear from which you took the seed; but you are all in the dark; it is not a necessary result: whereas, if you adopt the method which has been so well described by Capt. Moore, you know with a very great degree of certainty that the male portion of the fertilizing element must have been first class. Does Mr. Comins see the point?

Mr. COMINS. I see the point: but I would like to interrupt you a moment to say that Nature also comes to my aid in this thing; for the best male stalks are developed about the time that the best female organs are ready to receive the pollen, and therefore they are more likely to be fertilized by those. Indeed, they are fertilized by those; because it is only during a very short period of time that this fertilization can go on, and the female organs are much more likely to be fertilized by those very vigorous early-developed stalks than by the puny ones which are not developed. Nature comes to my aid in that thing.

Capt. MOORE. Would you undertake to say that they were not fertilized by imperfect stalks which blossomed at the same time? There is the point. I don't think you have covered it at all.

Mr. WHITAKER. I want to make a statement here in regard to this matter. We say that the same laws which govern fertilization and cross-fertilization of plants also govern the fertilization of animals. I used to go into Canada every year. At one time I saw a very fine breed of Essex pigs at Hamilton. I bought a couple of those pigs, — a boar and a sow, — both bred from imported stock, but from different breeders. I brought mine home, and in the first litter of pigs there was a black-and-white one. There was the evidence that I had not got pure stock, — a black-and-white pig. I wrote directly to the gentleman in Hamilton from whom I got them, stating the fact. He wrote back that he had guaranteed the purity of the stock; that the head of the family that he had imported had been guaranteed, and that from his he had no black-and-white pigs. He wrote directly to England; and he got compensation on his guaranty, and I got compensation on my guaranty. I never raised from those two pigs a litter of pigs in which I did not have one black-and-white. Now, this man guaranteed my Essex

pigs; and, in guaranteeing my Essex pigs, he guaranteed that they should be totally black. They were not. There was the evidence that somewhere or other something else had crept in.

Mr. HADWEN. Were there pigs of any other color on your premises?

Mr. WHITAKER. There might have been among some of the others, but not with this pair. I had the satisfaction of knowing, also, that, as long as I kept that boar and sow, they always produced one black-and-white pig in a litter; never more, but always one.

Now, I just make this applicable to Mr. Moore's suggestion. Mr. Moore selects a quantity of seed raised in the manner he has described; and I buy it from him, and he can pretty near guarantee what that seed will be. I go to Mr. Comins and buy some of his seed; but he cannot guarantee what that seed will be. I have never raised much corn; but I have raised on wo bits of land sweet-corn and field-corn, with two or three acres between the two. In my sweet-corn I had field-corn dotted through the ears, and in my field-corn I had sweet-corn dotted through the ears. Then I took the sweet-corn that came out of the field-corn, and planted that, and I got a large portion of field-corn in the ears: there would be some sweet-corn sprinkled among it. On the other hand, I planted the field-corn, and got sweet-corn. Now, I could not say, if I turned that over to anybody, "Here is some sweet-corn that will *surely* produce sweet-corn."

Now, we say that "like always produces like." Well, if it did, there would be a poor chance for me and brother Moore. But there is another law, and that is the law of variation. It is from the law of variation that all improvement or deterioration commences. I have always said, in speaking to men, "God has placed it in your power to make yourselves either better or worse. The law of variation applies to you and to your moral condition just the same as it applies to the physical condition of the animal." Now, we have that variation in our power in the cultivation of plants. Mr. Moore, when he passed down between his rows of corn, would select his best ears, and his corn would begin to improve. Another man would take his at random, and his corn would begin to deteriorate. One man whom I knew was

very fond of pease, and he always ate the first that came on his vines. Another man loved pease as well as the other; but still he had some little restraint upon himself, and always saved the earliest of his pease for seed. The result was, that, in a few years, the first man had run his pease out, so that they were neither early nor late; while the other had developed his pease until they were nearly as large again as the pease he commenced with, merely by restraining his appetite.

Now, I tell you there is a great deal in restraining the appetite of your animals, if you want to breed good stock. If you have a good animal, and let him run indiscriminately anywhere and everywhere, you will have pretty poor stock, if you have any at all. If you want good stock (and it is the same with the fertilizing powers of the corn), use it judiciously, and use every thing else just in the same manner.

Mr. SLADE. I did not think of saying any thing this morning; but I regard this matter of saving seeds and improving them as one of the utmost importance. It is a matter that has grown on me. Formerly I did not think a great deal about seed. I thought, if I got good seed, that would do. But I recollect asking Capt. Moore a question in regard to Danvers onion-seed some dozen or fifteen years ago; and he said, "You had better pay fifteen dollars a pound for the very best than to have *good* seed given you." I thought then that that was an extravagant statement; but I changed my mind afterwards. I believe, if a man is going to plant an acre of onions, he had better pay fifteen dollars a pound for the best seed than to have good seed given him. If I were going into it next spring as an investment, I would pay that rather than to take good seed for nothing. The matter of improving seeds is something, in my estimation, that every one should do for himself: it is something that cannot be very well delegated, and I will tell you why I think so. I think an improved kind of corn, or a new potato, or any thing of that kind that is newly originated, does a great deal better on the soil and in the locality where it is improved, or where it is originated, than it does when it is moved off; for instance, the corn improved by Mr. Comins will do better in the valley of the Connecticut, and may do first-rate there, and still, if bred in Plymouth, be

almost a failure. I know that such is the case, for instance, with the Early Rose potato. The first two or three years that it was planted in Bristol County, we could not get a great yield from it, although we took extra pains. We paid a dollar or two a pound for it, and of course we did every thing we could to get a large yield. I remember the case of a neighbor of mine who kept that seed. It did not do very well at first; but this last year he got a hundred and sixty bushels of Early Rose potatoes off of three-eighths of an acre, and he is selling them now for seed next spring at a dollar and a half a bushel. Such was my experience in planting the Early Rose: the longer I planted them, the better they were, and the more they yielded. And such is my experience in regard to almost any other potato.

Now, in regard to corn. A few years ago Capt. Moore originated a variety of corn in Middlesex County which I knew did splendidly there. That corn was taken to Bristol County, and taken to Rhode Island, and was almost a failure; but still it did splendidly along in this latitude, as everybody knows.

Now, there is another thing. You may take strawberry-plants from New Jersey, or even from Connecticut, that stand high, and are great producers of hard berries, of good flavor, and all that sort of thing, and they are liable to prove utter failures: there is no certainty about them. That has been my experience. Some dozen years ago I bought some plants in New Jersey and brought them here; but the thing was a complete failure, although the plants did well there. And it is so here. A plant, in order to do well, should be used pretty near the vicinity where it originated. That is my idea about it, and consequently a farmer must use his own brains. A man in Plymouth County, if he wants a good potato, had better originate it here than rely upon some one in the western part of the State, or some one in New Hampshire or Maine; and, if a man wants to get pure seed-corn, he had better get it himself than rely upon some one a hundred miles off to do it. When the King Philip corn first came about, it yielded better, in the vicinity of the place where it originated, than any other corn there was about at that time, and we were all very anxious to get it. I know I got a bag and planted it, and it was a failure. Well, one man had so

much confidence in it, he said he was going to plant it another year. He was the only one that I knew of who continued to plant it, because it failed so universally. He planted it a second year, and it did better; and he continued planting it for several years, and it improved so much, that the yield was about what was promised for it when it was first brought out. He got about sixty or seventy bushels to the acre. But it is well known in Bristol County, that, when that corn was introduced, it was a failure, and very rarely would you find a person who planted it the second time. I have tried strawberry-plants that were originated, for instance, on the Hudson River, that in my vicinity were complete failures; whereas I know that where they originated they are a first-class berry. I used to raise onions years ago, and I sent over to Danvers and bought the seed. Almost everybody who raised onions, clear down to Bristol and Warren, wanted to raise Danvers onions: they had heard a great deal about them. The first year I planted them, I was very much disappointed that they did not come up to my idea of what a perfect onion should be by any means; but I made the best selection I could, and raised my own seed for several years. The last year that I raised onions I raised about five hundred bushels, and they were perfect almost. By making judicious selections, I improved them, I thought, very much. They yielded almost double the fifth year what they did the first year; and that was the experience of all the vegetable-growers about there. It goes to show, to my mind, that any fruit or seed or plant does better on the ground where it originates.

Mr. CHARLES W. CUSHING (of Hingham). I take this opportunity to invite the gentlemen present to look at my corn on the table in the hall below. I got the seed from the Daniel Webster farm twenty-five or twenty-seven years ago, and have planted it ever since. If gentlemen will look at the sample, and then come and look at the farm it was raised on, they will have a chance to see whether it has deteriorated. The seed is selected at husking-time. We must rely on facts in these discussions; and the only way to get at these facts is to go right on the ground, and see where the cattle, the hogs, and so on, were raised.

Mr. PAUL. I have been so much interested in the paper

which has been read, and in this discussion, that I want to relate a little matter tending in the same direction, to show the differences that come from different kinds of seed. Some years ago I set out, one spring, ten thousand asparagus-plants. Six thousand of them were the so-called "Conover's Colossal." I paid a dollar a thousand more for them, because they were supposed to be better. I set them on the best part of the field, and set out the four thousand on land adjoining. For some reason or other, only a small part of the six thousand plants came up,—probably about two thousand. They have been an eyesore to me all these years. I have threatened to plough up that portion of the field repeatedly. I have not kept the asparagus separate, so as to know just the number of bunches; but I am satisfied in my own mind, as well as if they had been actually counted, that I have never got more than half the bunches from the six thousand plants that I have from the four thousand, and the bunches have been inferior in size; not because, as I understand it, they were of that particular name, but because of some defect in the seed. They have had the same cultivation, the same manure and every thing, except that they had the best part of the field. I cannot tell you what I have lost by it, but, I am satisfied, some hundreds of dollars. How much more I shall lose if I don't plough them up, I do not know. I mention that as one fact which I know in my own practice.

Capt. Moore. The Middlesex South Agricultural Society examined, I think, two square rods of Dr. Sturtevant's corn for a premium, and they made a hundred and thirty-two bushels to the acre. According to Dr. Sturtevant's own statement afterwards, when he came to sell it, there were eighty bushels. I don't know, but I think, when you measure a field of corn by two square rods picked out in the field, it is, to say the least, pretty unreliable.

Mr. Comins. I want to raise a little question about ascertaining the yield of corn by measurement. I undertook to raise a hundred bushels to the acre: I knew from a previous yield that my land would produce forty bushels to the acre. It was applied to land in just the same condition, although it was not the same year. I failed to get my hundred bushels of corn, although it seemed to me that it was the stoutest

corn I ever saw; but I got ninety-eight bushels. I weighed every basket of it on the scales.

There is another question which Capt. Moore opened here, upon which I want to relate an experiment which I have been trying. He says, that, when he manures a piece of land for any crop, he puts on a good stout dressing of barnyard or stable manure, and then he uses his judgment about what kind of fertilizer to put on; that, for the onion-crop, he will apply potash, because that crop takes a large quantity of potash; that, for some other crops, he would put on nitrogen, because they take largely of nitrogen; and on still others, phosphoric acid, because they take largely of phosphoric acid. Now, I experimented with corn: I took a plot of land; and on a part of it I put just the quantity of phosphoric acid, nitrogen, and potash that are found in the corn-crop. Knowing as I do, and as everybody knows, that there is a large amount of nitrogen in the air, that the great reservoir of nitrogen for our crops is the air, I left out on a part of the plot one-quarter of the nitrogen, and on another part one-half of the nitrogen. The corn from each plot was measured by weighing, and the shrinkage in the corn was approximate to the quantity of nitrogen which I left out. I know of the same experiment being tried in other places upon the same crop, and with almost universally the same result, or approximately the same result: therefore I do not believe that we can depend altogether upon our analyses in determining how much of this thing or that we shall apply. In the first place, it is a very uncertain quantity. What is "a good stout dressing of barnyard-manure"? Capt. Moore's manure may be worth four times as much as his next neighbor's; and we do not know, we have not any measure of, what we want to put on in barnyard-manure. I do not advocate throwing this away: all the waste material, as Capt. Moore says, should be first completely utilized; then we can buy our fertilizers in the market; and at the present day we can buy just what we want to buy, and we can know just what it is, and just how much it contains, and we can put it on, and uniformly produce the same results, or approximately the same results; and thus really the commercial fertilizers that are in the market have an advantage over barnyard-manure at the present day, in that

they have something by which we can calculate their worth, whereas, if we go into the market and buy the barnyard-manure that is manufactured in or near the large cities, we do not know whether we are getting our money's worth or not. And in applying barnyard-manure, or in attempting to apply this thing or that thing, to the crop, we are working at random: we do not know exactly what we are doing.

Adjourned to two o'clock.

Afternoon Session.

The Board met at two o'clock; and the Chairman introduced Dr. James R. Nichols of Haverhill, who read the following paper: —

THE NEW AGRICULTURE.

BY DR. JAMES R. NICHOLS.

Science has accomplished so much for practical agriculture during the past third of a century, that, in contrast with former knowledge and former methods, it may be said with great propriety and truthfulness that we have a *new agriculture.* The old agriculture rested upon ignorance, and to some extent upon superstition; the new, upon science and practical knowledge. It was doubtless discovered in early historic times that plants were stimulated, and their growth promoted, by bringing in contact with them animal excrement, and other organic bodies which had undergone, or were capable of undergoing, putrefactive change. It was also known that irrigation and stirring the soil in some way contributed to the welfare of plants, and beyond these simple facts all was darkness. The Greeks and Romans, within historic periods, knew but little more; and indeed it may be said, that, up to the commencement of the last century, scarcely an inquiry, or an attempt at investigation, had been made respecting the mysteries of plant-growth. The old alchemists, by their absurd and empirical labors, really accomplished something for art and manufactures, but nothing for agriculture. The reason for this is obvious: they were more intent on discovering some method of mak-

ing gold than of promoting those industries upon which the production of food depends. They manipulated the earthy and metallic substances, in their efforts to turn lead, iron, &c., into gold, and utterly neglected to examine the properties of vegetable and animal substances. They knew nothing of the constitution of air or water, or any gaseous body; and hence, if they had turned to the investigation of organic structures, the obstacles in the way of success would have been too formidable for them to have encountered. When Dr. Priestley came upon the stage of action, his brilliant discoveries and experiments brought in a new order of things. Evelyn, Boyle, and specially Hales, had made some valuable discoveries in regard to plants before Priestley's time; but it was he who laid the foundations of agricultural chemistry. Dr. Black came to the aid of Priestley in his great discovery of carbonic-acid gas; and he soon pointed out that plants had the property of purifying the air by decomposing the carbonic acid, appropriating the carbon, and restoring back to the atmosphere the oxygen, — a principle necessary to the processes of combustion and respiration.

These were great discoveries, and stimulated inquiry into the mysteries of organic life to a degree never before known. But, up to the close of the last century, nothing of importance was known regarding the food of plants, the chemistry of their growth, nourishment, &c. The coming-in of the present century witnessed intense activity in this field of research; and the labors of Humboldt, Berzelius, Gay-Lussac, Lavoisier, Prout, and many others, served to present a very accurate knowledge of the nature and composition of organic bodies. The dawn of a new science had burst upon the world, that of vital chemistry; and the enthusiasm and zeal awakened among investigators was very great.

The first chemist (if he may be called such) who ever wrote upon agriculture, was one J. G. Wallerius, who, so early as 1774, published a book on "The Cause of Fertility." It abounds in crude speculations, and affords but little real knowledge based upon experiment. Eleven years before, another book upon agriculture appeared, called "The Rational Farmer," which is indeed a curiosity, and well worth looking over in this age of advanced scientific knowledge.

It contains accounts of numerous rude chemical experiments, all of which go to prove that the author was no chemist. There are, however, some practical facts contained in the volume, which were of no inconsiderable value, if they were understood and heeded by the farmers of that age.

Among the names of those conspicuous for researches in the field of organic chemistry at the commencement of the present century are those of Davy and Berzelius; but they fell into errors, and their deductions are so erroneous, they serve to show how very imperfect and incomplete the sciences were fifty or sixty years ago.

It was not until the advent of Liebig that the cloud of error was dissipated, and the doubts and uncertainties which surrounded the subject were removed. He showed very clearly how plants obtained their food, what were the sources whence they derived the elements, and the nature of the office performed by manures. He gave the results of careful experimental labors which supported the correctness of his statements; and most of his deductions stand to-day as demonstrated truths. Prior to his time, it was generally supposed by chemists that plants derived their carbon from the soil, although it must be stated that Priestley and Ingenhousz quite early adopted the view that it was supplied by the air. It was deemed impossible that plants could possess the capability of exerting a decomposing force in the separation of carbon from oxygen greater than could be produced in the laboratory, with the aid of powerful acids and intense heat. Liebig, however, established the fact on a firm basis, that the largest portion of plants, the carbon, is elaborated from the invisible atmosphere, and, without its agency, no plant-life could exist.

The element nitrogen was a stumbling-block in the way of the early chemists; and they were unable, with their imperfect methods of analysis, to detect its presence in plants. Liebig demonstrated that it always exists in the same proportion in certain constituents of plants, and the substances containing it are those which form the most valuable part of food. He showed the sources from which this most important element is derived; or, at least, in his early work, "Organic Chemistry applied to Agriculture," he points out the agents through which it is supplied in the

greatest abundance, as ammonia and nitric acid. Prior to his researches, it was known that nitrogen was not absorbed free and uncombined from the air; but much confusion existed as to the exact sources from which it was obtained, and the methods of its appropriation by plants.

The earthy or inorganic substances in plants were detected by the early chemists; but as regards their importance and office, or how they were derived, were matters very imperfectly understood. It was supposed for a long time that lime, silica, iron, &c., were accidental constituents of plants, and that the atoms were carried into the structure by the ascending sap, and that the plants would be better without them. It was impossible for these zealous investigators, working in imperfect light and with rude apparatus, to comprehend the great truth that the inorganic constituents of plants are absolutely essential to their development, and that growth is retarded in their absence.

In the last century and in the first part of the present, numerous writers upon agriculture appeared, not only in England, France, and Germany, but also in our own country. The great struggle which occupied the time and thoughts of our forefathers was that of subduing the rocky, forest-covered lands of New England, and they had little time to devote to what are now called "crop experiments," or "fancy farming." The clergy seem to have been about the only class who had leisure to think or read much, and they had topics enough for study in the new world in which they were located. The great problem, how to increase the productiveness of the new fields laid open to the sunlight by the axe did not escape their attention; and sermons and essays were written and delivered, bearing upon agriculture, some of which exhibit a large degree of intelligence and sagacity. The best among them was a New-England clergyman, the Rev. Jared Eliot, M.A. His little volume, "Essays upon Field-Husbandry," was printed in Boston in 1760, and is distinguished for most excellent good sense and a knowledge of the practical duties of the husbandman. He is not pretentious, and lays no claim to knowledge other than what he has obtained by experience: consequently the reader is not troubled with many absurd speculations, such as characterize most of those who wrote upon agriculture

one hundred years ago. His clerical instincts, however, do crop out persistently, as at that early day Bible hints in geology, cosmogony, &c., were taken in a literal sense. Regarding peat, he remarks as follows: "As to the formation, original, or matter of which peat is produced, it is reasonably supposed to be made of the wood which grew before the flood."

The "flood" to the old divines was a great event. He says again, in deploring the state of knowledge then existing among husbandmen, that the "only rules of husbandry that I have met with I have found in the Bible." Rather an unsatisfactory set of "rules" for farmers, as judged by the light of the present day. Of fertilizers outside of "dung" he has considerable knowledge. "Ashes," he says, "is allowed on all hands to be some of the best dressing or manure for land: it enriches much and lasts long; *but the misery is we can get but little.* It is a frequent saying, if we could get a sufficiency of ashes, we could do well enough. It takes a great deal of wood to make a little ashes. But peat will yield abundance of ashes, and very excellent too." With no methods of analysis by which the comparative value of ashes could be positively ascertained, it is no matter of wonder that the error should be entertained that peat-ashes possessed a high value. We now know that they are almost worthless as a manurial agent.

The reverend divine advocates sowing seed early in the morning, before sunrise, as, he observes, "it is agreeable to reason that it should do good; *for the dews are impregnated with nitrous salts*, and is the principal thing which enriches the ground." This is a remarkable statement; for it proves that at that early period, before the element nitrogen was known to exist, observation had taught that the salts containing nitrogen were useful to crops. He is sagacious enough to predict the threshing-machine, and remarks "that there is no doubt but what wheels could be so contrived as to thresh out a great deal of grain in a day."

Regarding the ploughing of land, he advocates strong teams and thorough work. Quoting the passage 1 Kings xix. 19, where it is stated that "Elisha was ploughing with twelve yoke of oxen before him," he waxes eloquent, and exclaims, "*This was a mighty team!* It must have been a

plough of very different structure from what is now in use."

He also advocates cultivating small parcels of ground, and, by high manuring and tillage, obtaining great crops therefrom. He draws his arguments for this course from Roman history, and he declares that "the old Romans lived upon small shreds of land." He continues: "From scraps of Roman history we may collect and conclude that a little good land will support a family, and that, to make it yield so much, they must have had an art and skill to which we are strangers. To attain that skill which is lost, or to find out something now to substitute in the room, is our proper business." It is also, we may say, the "proper business" of farmers in our time to find out how to obtain large crops from "small shreds" of land.

We have been greatly interested in the perusal of this book, and have read it several times. It is very rare, and few copies can be found. It was a treatise highly esteemed at the time it was written, as the author says, "The essay has met with a more favorable reception than I expected, *fifty copies* having been sent for by B. Franklin, Esq., of Philadelphia, a person of merit and learning." Franklin was a patron of every thing that tended to advance human knowledge, and promote the happiness of mankind.

It is a curious illustration of how slow is the progress of enlightenment, and how often is repeated the same old processes in agriculture, that two years since the Essex Agricultural Society awarded a premium to a farmer for a process of reclaiming waste pasture-land; which method is fully described by Eliot as followed one hundred and twenty years ago.

But I must turn from the old agriculture to the new.

The *new agriculture*, as has been said, is the result of scientific investigations conducted within the period of a little more than a third of a century; and to Liebig are we greatly indebted for systematic researches which have led to a better knowledge of the scientific principles upon which rests the success of the husbandman's labors. Coincident with the birth of a "new chemistry," and dependent upon it to a large extent, we have a new agriculture. It is not, however, to chemistry alone that is due all that has changed the

methods of husbandry, or enlarged the boundaries of knowledge so wonderfully in rural industries: the other collateral branches of science have come in to aid in the important work.

To vegetable physiology we are indebted for much that is of the highest importance to agriculture, and this department of study has kept pace with the progress of chemistry. The two branches are, in fact, to a great degree correlated, and the one must almost necessarily depend upon the other. It is quite impossible for us to understand the changes going on in the organs of plants, if we are wholly ignorant of the forms and structure of those organs; and, on the other hand, the most complete knowledge of the anatomy of vegetables could never lead any one to sound and correct conclusions respecting the nutrition of plants. The student who wishes to understand the new agriculture, and to become an intelligent and successful husbandman, must confine his studies within no narrow limits; but his researches must be broad, comprehensive, and accurate.

I have said that the new agriculture rests upon science and positive knowledge, but this remark must not be understood to mean that all the various departments of modern husbandry rest upon pure knowledge or demonstrated facts, for this position would plainly be indefensible; but I do say that the great fundamental principles are understood and established as clearly as those of most other branches of human knowledge. I do not claim that agriculture is a science in itself considered: it may more properly be designated as an industry dependent for its highest success upon science, and closely correlated with all the sciences. So far as the chemistry of plant structures and the forms of food they require are involved, our knowledge is positive; and also it is true that most of the details of practical farm industry are now so well understood they may be said to be almost or quite removed from the regions of doubt. This may sound strangely to those gentlemen who persist in regarding every thing in rural pursuits as unsettled, or as still within the field of controversy. There is something ludicrous in the attitude of a large number of farmers who seem to regard every movement or operation on the farm as involved in a cloud of uncertainty, and every step they take as

governed by chance or blind caprice. This feeling belongs to the epoch of the old agriculture: it certainly does not to the new. It crops out in nearly all our farmers' meetings in the way of disputes and controversies; and these are often so confusing, that beginners in rural occupations retire with minds darkened with doubt, and disturbed by fears. As I have said, this frame of mind is or would be ludicrous, if it did not oppress by a sense of its utter unprofitableness and mischievous tendencies. It is high time that settled points in husbandry were allowed to rest among fixed and adjusted facts, and the time spent in disputations devoted to enlarging the boundaries of knowledge, — pushing the way into the dark regions where explorers have not ventured.

And now let me stop to inquire as to what are some of the points which the new agriculture requires us to look upon as not open to controversy. The field brought to view by this inquiry is indeed a wide one; but let us enter it, and see what may be found that aids in answering aptly and forcibly the question. At the very threshold of this topic I am led to say, it is settled that successful agriculture demands *brains*, just like all other industrial occupations. The old notion, that any one not an actual fool or dolt could carry on a farm satisfactorily, is certainly incorrect, and the noble vocation of the farmer should no longer be associated with a view so erroneous and degrading. Agriculture never rested on so low a plane as this view implies, — never, not even in the midnight of mediæval times. The apt, bright Japanese, and the ingenious, patient Chinaman, unprogressed as they are supposed to be, alike repudiate ideas of this nature. Parents in those countries, we are told, place their stupid, feeble-minded sons in positions suited to their capabilities, — as burden-bearers, or as workers upon canals or in stone-quarries. To properly cultivate the soil, they rightly assume, requires good judgment, quick perception, ingenuity, and industry. Their methods are crude and laborious; for they are guided only by experience, not by science; and yet they manage, in their ways and under their system, to place before us some excellent examples of high tilth and effective farm management.

Any boy graduating at a law school, who would become a briefless lawyer from incapacity, would, on the land, be a

thriftless farmer; and the same may be said of cheap, unsuccessful doctors, ministers, and artisans.

It is a mistake to assume that all soil-cultivators can be successful in the calling: they cannot be any more than every one can be successful in other occupations, and we know there are miserable failures all about us. It is a settled maxim that the new agriculture rests upon brains, upon intelligence, upon culture.

What may be called the minor points in practical agriculture which I regard as settled are very numerous, and yet hardly one of them rests easy in its place. No one ought to dispute that it is advantageous under all circumstances to raise the very best products of every kind which the earth is capable of producing. It is the best butter, the best cheese, the best fruits, the best flour, the best hay, that sells the quickest, and brings the best prices. A poor product gives no proper remuneration to the producer, or satisfaction to the consumer. It is the farmer's business to learn how to raise the choicest products as well as to learn how to secure the largest results; and it is the special mission of the new agriculture to furnish information upon these points.

In the manufacture of butter, for example, it teaches, that, in order to reach the highest degree of perfection, not only must the best breed of cows be kept, but temperatures must be observed carefully in all the stages of the manipulating process; the thermometer must be used; and, further, the utmost cleanliness is indispensable to success. Common butter can be made in the old, common way, — without ice in summer, without convenient, cool, dairy-rooms, without working-implements, without care in excluding it from offensive odors; and it may be salted without weighing or measuring the salt. High grade or gilt-edged butter will at all times command from forty to eighty cents per pound; common, from seventeen to twenty-five cents. Is it not wise to strive to produce butter of the highest quality? Apples and other fruits may be grown on impoverished or overburdened trees, and, when gathered, thrown carelessly into barrels, and sent to market. The price for such fruits is always low. Apples well grown, well selected, and well picked, will sell well, even in years like the present, when the crop is over abundant. The wise and enterprising manufacturer labors to

secure a *reputation:* why should not the farmer? The farmer who acquires a reputation for unusual excellence of products, no matter what they may be, is sure of success and pecuniary independence.

It is astonishing how apparently trifling changes in methods, or unusual care in selecting and manipulating farm products, will influence sales, and enhance prices. Here is a farmer who shells his corn and grinds it in the careless, old way, indifferent to dirt or mould; and over the way is another, who selects sound ears, shells, and winnows out every particle of cob and dust, grinds in a clean mill, packs in tasty and secure packages, and the products of both go to market. The one gets seventy-five cents a bushel for his meal; the other, two dollars: one remains poor and obscure; the other secures a reputation, which is better than capital. One farmer, in making cider, grinds with his apples, not only the decayed fruit, but much filth in various forms, and stores the liquid in musty casks: another selects and washes his fruit, and every stage of the process is carefully watched, and neatness and intelligent skill constantly exercised. The products of one find a dull market at low prices: the other sells at high prices with a ready market.

One more example. Farmer A. raises pork: his hogs are kept in the old slovenly way, fed on garbage, or whatever the animals will eat. Farmer B. also raises pork; but his hogs are well cared for: the pens are cleanly, and a bed of straw is supplied for quiet repose. Sunlight and air are admitted freely to the pens, and also plenty of clean water. During fattening they are fed on good sound meal and shorts with skim-milk. Farmer A. finds a slow market for his pork at the present time at five or six cents per pound; while B. cannot supply the demand for his at fifteen cents a pound.

It is not alone the wealthy who are willing to pay well for nice, sound, and healthy farm products: mechanics and laborers of moderate means have learned that good food is worth paying for, and they seek for it at the sources of supply. The difference in price and facility of sale between products strictly first-class and those not quite up to a high standard is immense, and failure to observe little matters brings pecuniary loss. I have known a choice pan of butter

spoiled by a farmer walking into the dairy-room with his cow-stall boots on, covered with animal excrement. Butter and milk are extremely sensitive to odors, and absorb them rapidly. Apples of good quality packed in barrels loosely, without placing a layer in concentric circles, stems down on the bottom, sold at fifty cents less the past autumn than they would if a little more attention had been bestowed upon packing. Timothy-hay pressed or loose, which contains perhaps a hundred or two of lowland or meadow grasses in the ton, is often depreciated five or six dollars by the careless admixture. It is wise to aim at high excellence and uniformity in products. If any thing is grown upon the farm of second or third quality, sell it as such at the highest price it will bring, and never attempt to force it off under cover of better articles. This policy is manifestly the best, and it must be considered as established or settled.

The old, threadbare question as regards the utility or profitableness of raising green-fodder corn for forage should no longer be discussed: it is settled, and is or ought to be forever at rest. The sum of the matter is embraced in this statement: it is, under all ordinary conditions, in New-England farming, advisable and advantageous to plant corn for fodder in drills, with at least twenty inches space between, so that air and sunlight can have free access to the growing plants; but it is not good husbandry to sow it thickly broadcast, as has been the practice. The new agriculture supplies the reasons for this decision. It teaches that all plants depend for healthy growth and nutrition upon actinic light and heat, and upon access of air; and any plant that is deprived of these agencies in its growth is abnormal, and not suited for the food of animals. This is the whole matter in a nutshell. It is not necessary for us to spend any more long winter evenings discussing this question. In such discussions farmer A. gives his experience to show that he secured a great flow of milk from a herd of cows fed upon abnormal corn-stalks grown in the shade. This statement is given with the view of controverting the statements of farmer B., who is a better observer and more honest, who declares that he failed of success in similar experiments.

The questions as regards the best methods of feeding animals, and the most nutritive forms of food, are adjusted

questions, and are so regarded by advanced farmers. It is as absurd to suppose that one can obtain large milk-supplies from cows, or that cattle can be fattened, by the use of forms of food which chemistry proves do not contain the rich elements of nutrition, as to dream of fertilizing fields with dung destitute of those salts which plants require. In the time of the old agriculture all was hap-hazard in this direction, the actual money value of no one article of food was clearly known: now the whole field is illuminated by a flood of light. It would seem that analogy might have taught the lesson that animals, like human beings, thrive best when fed at proper intervals, and that no more food should be placed before them than can be consumed with a relish. Animals fed at any time when most convenient in winter, and, to save trouble, furnished with inordinate supplies of food, become nervous and restless, lose their appetites and flesh, and come out bad from the barn in the spring. Nature teaches that habits of regularity and moderation lie at the basis of animal health and strength; and, when hints from nature are supplemented and supported by the facts of analytical research, a farmer is dull indeed who fails to learn from the teachings thus afforded. Animals, if well cared for, carded twice a day, and kept cleanly, thrive best in the barn in winter. During a period of ten years my animals have not been from under cover during a single hour in any day in winter. Water is brought to them through pipes into the stalls, and the manure is removed as soon as dropped, and the cards are used freely. In this way the health of the animals is kept perfect, and the flow of milk is regular and in full quantity. As a matter of experiment, when a herd of seventeen cows were supported at the farm, in the winter of 1871, they were permitted the range of the yard one hour on several moderately cold days, and, in consequence, the falling-off in milk was about nine quarts in the herd each day when exposed. I have been greatly interested in observing the effects of cold upon the milk-secretion in both summer and winter.

During one summer, in the hot days in July and August, the animals resorted to the lake to drink, and, after slaking their thirst, they would wade into the water, and remain, sometimes an hour or two, with the legs half immersed.

This habit, it was found, invariably diminished the flow of milk at night; and, in order to learn the extent of the diminution, careful observations were made. It was ascertained that standing in the water an hour diminished the flow to the amount of one quart to each animal. The loss was so great, that, whenever they resorted to the water, they were driven away to the pasture again at once. A draught of ice-cold water taken by a cow in winter cuts short the milk yield for the day from one to two pints. Well-water drawn into vessels, and allowed to stand a few hours covered in the warm barn, has its temperature raised several degrees; and this practice should be adopted by all thrifty farmers. It would undoubtedly pay well to warm the water slightly; but this is attended with considerable inconvenience, where large herds are kept, unless steam apparatus is used. The influence of a cold current of air, and cold drinking-water, upon cows in milk, is not of a transient nature: it extends for a longer period than a day or a week. Many fine animals are ruined by careless exposures every year; and self-interest and feelings of humanity should prompt all cow-owners to keep diligent watch over their welfare and comfort.

Cows in milk are often greatly injured by rapid driving from pastures by heedless boys and unthinking men. They should never be urged faster than a walk. Gentleness and kindness of conduct towards cows have a wonderful influence upon the milk-pail, and also upon the progeny of the animals. A bad-tempered, irascible man ought never to be allowed in a cow-stable. A man who will kick a cow in a passion ought himself to be kicked into the barn-yard, and forever prohibited from again coming in contact with the noble animal. The right person placed in charge of a herd of twenty cows which have been badly managed will in one month raise the lacteal products so that the increased cash returns will pay his wages. This is a statement the correctness of which has been verified more than once. The new agriculture does not permit of the rough treatment of our domestic animals, so common under the old. There are so many practices which it forbids, that I am embarrassed by the number, and can only briefly call attention to two or three most prominent. The practice, so common formerly, of applying considerable quantities of salt to hay in the mow,

is no longer permissible. This practice of salting hay was done in the belief that it preserved the badly cured article, and prevented it from moulding or fire-fanging under cover. Such, however, is not the case, as the water of crystallization in the salt, and which appears in the mow, adds to the difficulty of keeping or preserving damp hay. Some of the worst specimens of injured hay that have come under my notice were those upon which salt had been freely deposited in the barn. Weak brine has no preservative action upon hay, and it is astonishing that even the careless observation of the farmers of a former period did not establish this fact: even now many farmers hold on to the delusion, and keep up the bad practice. A little salt thrown upon a mow of hay, regarded as condiment in the food of animals, may not be very objectionable: still it is manifestly better to use salt in more concentrated forms of food, and under conditions where it may be more accurately measured.

The old error that dung was dung, and of uniform value, no matter from what forms of food it was produced, is now, to a considerable extent, understood and recognized; but there are many farmers who have not yet learned that manure from run or meadow grasses is not as valuable food for plants as that from the best upland varieties, and it is this class of farmers who have not learned that manure under cover and properly cared for is worth double that exposed to rains and washings at all seasons of the year.

The new agriculture forbids farmers to allow meadows and lowlands which are suited to reclamation to remain in a wild condition, producing only swale-grasses and worthless bushes. The most profitable expenditure which can be made in husbandry is bringing into good tilth, by ditching and draining, peaty lowlands; and such are to-day the most valuable and remunerative of our New-England fields. If a farmer has such lands, let him take hold of them with energy, guided by intelligence. If he completes his haying on any Saturday night in July, let him go with his boys and men into his lowlands early on the succeeding Monday morning, and not allow an idle hour to occur during the dry season, until the work of reclamation is finished. Such lands brought into good tilth are like money at interest, or like a bank which never dishonors a draft. I have had much of

this work to perform, and it has proved the most satisfactory which has engaged my attention.

Some of the most important facts connected with the new agriculture relate to the nature and nutritive value of the different products of our soils. We now understand the actual and relative values of corn, wheat, oats, barley, &c., and also we understand the value of some root and other crops not known to the old agriculture. The value of our corn as a nitrogenous or sustaining food for men and animals, and also as a fattening food, is clearly recognized by every good farmer. It is well adapted to our New-England soils, and is by far the surest and most remunerative of all the cereals. Instead of the crop of twenty-five or thirty bushels to the acre, which our forefathers under their system were able to obtain, eighty and even one hundred bushels are now not unusual upon our best fertilized lands. It must be indeed an extraordinary season when the crop fails: in fact, may I ask of you, gentlemen, the question, Did it ever fail? Perhaps it did in the cold season of 1816; but that was a phenomenal or exceptional year, with frost every month from January to December. The past summer has been, in certain sections of our State, perhaps as unfavorable as any within the experience of most of us; and yet the crop has been fairly remunerative. In Essex County the rainfall was less than three-eighths of an inch in amount from the 20th of June to the 26th of July; and nobly did this cereal bear up under the intense drought. What other of all our crops withstood it so well, and gave such fair returns? The corn-crop is the most promising of all under the new agriculture; and we must largely increase the acreage devoted to it in the coming years.

Our best varieties of New-England corn afford by analysis, in one hundred parts of

Flesh-forming principles (gluten and albumen)	12.60
Fat-forming principles, gum, starch, sugar, oil, &c.	77.09
Salts (mineral)	1.31
Water	9.00
	100.00

This result teaches us that, in corn, we have stored up for the use of men and animals a vast proportion of those rich

elements which are needful to maintain health, and give strength and warmth to the animal economy.

An interesting question came up for consideration and investigation several years ago, and has recently awakened further inquiry. I allude to the matter of the nutritive value of corn-cobs, and the advisability of grinding them with the kernels, and feeding them to animals. Before giving careful attention to the subject ten years ago, I had misgivings as to the utility or wisdom of the plan; but investigation settled the matter. With the view of ascertaining as nearly as practicable the exact nutritive value of corn-cobs, I selected a well-formed ear of corn raised at my farm, from a bundle of ears, and, removing the kernels, subjected the cob to analysis, with the following result. One hundred parts gave, of

Water	7.48
Crude fibre	30.95
Ash	1.16
Carbo-hydrates, fat, and albuminoids	60.41
	100.00

The amount of fat was not accurately determined; but it was proved to be more than one per cent. The amount of water is probably smaller than it would have been had the corn been taken directly from the grain-house, instead of the warm room in which it had been hanging for some weeks. The results of the analysis prove that there is in corn-cobs a considerable amount of fat-producing and flesh-forming constituents. In the sixty per cent of carbo-hydrates, albuminoids, fat, &c., are found the elements which have nutritive value; and, in order that we may obtain some idea of its comparative worth, let us contrast it with the dry straw of some grains. Wheat-straw contains about 30 per cent of carbohydrates, 2 per cent of albuminoids, and $1\frac{1}{2}$ per cent of fat; oat-straw, 38 per cent of the first-named substances, $2\frac{1}{2}$ of the second, and 2 of the third; rye-straw, 27 of the first, $1\frac{1}{2}$ of the second, and $1\frac{3}{10}$ of the third. It is shown that cobs have a higher value than wheat or rye straw, and they equal in nutritive constituents the best quality of oat-straw. These results indicate the utility of feeding them to our animals, provided there are no objections of a strictly physical nature,

or objections arising from bulk, and difficulty of reducing the cob to a sufficiently fine powder. It is not probable that cob-meal can be perfectly digested unless comminution is carried to an extreme point, and therefore the finer the cobs are ground, the higher the value, and the less the liability of gastric disturbance. It is certain we do not give sufficient attention to the matter of grinding any of the grains fed to our animals. They should be ground *as fine as possible* in order that they may be easy of digestion, and in order that the nutritive substances may be fully utilized. There is a positive loss in feeding out coarsely-ground grains of any kind, and, in grinding the cob with the corn, give special attention to the work of comminution. The corn in the ear should be thoroughly dry before it is carried to mill, and there will be less difficulty in reducing it to a fine powder.

Investigation has also shown that a bushel of our sound New-England corn, ground with the cobs, affords equal nutritive value with the ordinary Southern and Western varieties of whole corn-meal. The variety of corn grown at my farm, and which has been made the subject of experiment, has eight rows of plump large kernels, with a small cob. The proportion of corn to cob, when thoroughly seasoned, is as ten to two by weight, a bushel of ears weighing thirty-four pounds and a half. In one hundred pounds of the cob-meal there are eighty-three pounds of ground kernel, and seventeen pounds of cob, — five-sixths corn, one-sixth cob.

Probably different results would be reached by the use of corn with a large and heavy cob and light kernel. Such, in my view, should not be raised in New England; for it is wasteful and unprofitable farming. The cob, I learn from analysis, is a great robber of potash from our soils; and therefore we must not produce any more than is possible, if it is to be regarded as a waste product. The ash of the cob in the analysis of Lakeside Farm corn was not specially alluded to; only the percentage was given. In viewing this subject, some curious speculations occur to us. The average amount found in the ash of cobs is about seven pounds and a half of the carbonate in the hundred; which is twice as much as is found in the ash of the willow, the richest of all woods in potash. If it were practicable to procure and

remove the potash from all the cobs grown in the United States, it would indeed constitute a mountain of the valuable alkali.

The corn-crop of the United States for 1870 was 1,094,-000,000 bushels, of which amount

Illinois yielded	201,378,000	bushels.
Indiana yielded	113,150,000	"
Missouri yielded	94,990,000	"
Iowa yielded	93,415,000	"
A total, in four States alone, of	502,933,000	"

The corn-crop of the whole country for 1871 was 1,100,-000,000 bushels; which, at 14 pounds cobs to the bushel, will yield 15,400,000,000 pounds, or 7,700,000 tons of cobs, containing an average of three-fourths per cent pure carbonate of potassa. We have the enormous quantity of 115,500,000 pounds of that valuable alkali lost to commerce annually, which, if thrown into trade, would add very largely to the general resources of the country.

Before passing from the subject of corn, I venture to call your attention to a few points connected with the variety known as sweet corn. An examination of this variety was made in my laboratory several years ago with the following results. The specimen was procured from Faneuil-hall Market, and was fresh, and of the eight-rowed kind. The analysis gave, in a hundred parts of

Water	72.92
Fat	1.60
Sugar and gum	7.51
Starch	13.54
Nitrogenized substances	2.73

As the object was to ascertain the nutritive value of the corn, we present only those substances. It will be seen that the corn contained of fat, sugar, gum, starch, and nitrogenized bodies, more than twenty-five per cent. These principles give to green corn a high value; and whether it is fed to animals, or placed upon our dinner-tables, it has good claims to be regarded as among the important food substances. That we may understand what important changes are wrought in the grain by the process of ripening, we present

the analysis of dry corn as given in one of Professor Johnson's books: —

Water	12.00
Fat	4.06
Sugar and gum	2.07
Starch	54.04
Nitrogenized substances	8.08

Here we notice the great increase of fat, starch, and nitrogenous bodies, which give to ripe corn a still higher value, and render it a more concentrated form of food.

With the view of ascertaining the effects upon green corn of the process of cooking, and also the effects of keeping it in hermetically-sealed cans, analysis was made of two specimens found in the market, which were alleged to be preserved under different methods. The two brands are known as Winslow's and Durant's, and both corresponded in physical appearance when the cans were opened. The Winslow corn had, however, a stale, unpleasant odor; whilst the Durant specimen was as fresh as if it came direct from the dinner-pot to the table. The variation in the methods of treatment is wholly immaterial as regards good results; and the observed differences in the specimens are due to the age of the corn, and the cleanliness and care exercised in boiling and canning. The analysis of the two specimens gave the following results: —

	Winslow's.	Durant's.
Water	65.31	63.88
Fat	2.06	1.87
Sugar and gum	11.03	15.54
Starch	16.26	13.88
Nitrogenized substances	3.59	3.51

The water in the cooked corn is less than in the uncooked, as a portion of the natural juice is removed, and also the amount of fat, sugar, and gum, and nitrogenized bodies, is larger. This may be due in part to changes produced in cooking, and in part to differences in the corn existing prior to subjecting the specimens to this process.

We learn from the results of these labors that sweet corn undergoes comparatively few changes when cooked and kept many months, if air is excluded. If nice, fresh corn is selected, carefully cooked, and placed in clean glass vessels

hermetically sealed, it affords a nutritious and palatable dish in the winter months; and every family should secure a supply.

Sweet corn should be planted for green forage for animals, as *it* contains in a more concentrated form the desirable nutritive principles necessary for milch cows.

Perhaps the most important of the teachings of the new agriculture relate to improved methods of fertilizing and fitting our fields for the growth of crops. It informs us precisely regarding the nature of the substances in manures which constitute the food of plants: it separates the worthless from the valuable, and teaches us how best to apply manures to soils.

It also has opened to us the interesting and transcendently important fact, that nature and art have proved competent to supply in concentrated forms vast quantities of plant-food entirely outside of animal excrement: we have learned that the same salts found in excrement are provided by nature in certain combinations in the most lavish abundance. They do not exist in forms readily assimilable, like those in dung; but we have learned the simple processes of making them soluble and available, and thus our triumph is complete.

Some most interesting facts relating to the comparative values of excrementitious products have been taught us by the new agriculture, and we have learned of the curious variations in their value. We also have learned the reasons for these differences. Let me illustrate this point by considering briefly that form of plant-food known as night-soil. I have been led to conclude that human waste is far less valuable as fertilizing material than that of animals under ordinary conditions. This result has been reached through chemical analysis and practical trials in the field. The changes which foods undergo in passing through the organisms of men and animals differ in a surprising manner; and they arise in a large degree (not solely) from the influence or needs of the mind or intellect present in man, but not in animals. The human machine needs nitrogen to give muscular strength, the same as that of the horse or the ox; it needs carbon to give warmth, as does that of animals; it needs the phosphatic element and the earthy salts to repair bone-waste and to maintain the blood and secretions in normal condition the

same as animals; and here the parallel of comparison ends.

The mind in its functions is a *force* or power; and it must be *fed* or recuperated the same as any other force, or it becomes weak and abnormal. As regards separate forces in the living economy, we will assume that animals are controlled by two that are specially distinctive, — those arising from the nitrogenous and carbonaceous foods; while man is under the influence of three or more, the phosphatic force being peculiar and distinctive, as needed in an organism controlled by mind. What instinct is we do not know: we do know, however, that, like mind, it exists in greatly modified forms. There is just as much difference in the instinct of horses and oxen as there is in the minds or intellectual force of men; and it may be that this difference is manifest in the chemical nature of the excretions, as is shown in that of the highest order of animals. It may be that the waste of a highly intelligent or nervous horse is less valuable as plant-food than that of a dull, lazy animal: we strongly incline to think that it is. This modification, if it exists, is due to the action of animal mind or instinct solely: it has nothing to do with the modifications resulting from the exercise of the muscular forces.

The excretions of a working or a dray horse are not as valuable as those of a pampered animal, — one kept in the stall two-thirds of the time. The working animal uses up the nitrogenous element in his daily labor: the other rejects it through the alimentary and urinary canals. The excretions of students and persons engaged in hard manual labor are less valuable as plant-food than those from lazy, indolent individuals who think and work but little. The lost waste of the students and hard workers is in the direction of the phosphates and the nitrogen, — two of the most important agents needed by plants. The exhaustion of the important principles of plants in the human economy is under all circumstances greater than in the animal, and this is shown by analysis. The agency of the mind upon foods, even in its dullest manifestations, is very great; and human excrement must necessarily occupy a low place among fertilizing agents in the scale of values.

The analysis of human excretions in their combined form,

as found in the books, is singularly erroneous. Those of Berzelius and Boussingault, so often quoted, certainly mislead, and it is important that they be corrected. They mislead in so far as they are applied to estimations of the value of what is known as *night-soil.* We have found the actual phosphatic and nitrogenous value of the contents of town and city vaults to be *far less* than the estimates founded upon the statements of these chemists. If the waste of kitchens is permitted to flow into vaults, then we have altered conditions most important in their nature. The sink liquids are usually very rich in nitrogenous and potash elements, and we are inclined to regard them in sewage waste as of greater value than what comes from water-closets. The rapidity with which human excretions pass through the stages of putrefactive change detracts from their value, as the volatile and gaseous constituents are thereby quickly lost. Night-soil as such is beyond all question a *greatly over-estimated product* as plant-food, and it is important that any errors in regard to it should be corrected.

Next in importance to the discovery of new forms of plant-food is the knowledge how to apply them properly. In the spreading of barnyard-manure even, there is need of much skill; but the employment of the new concentrated fertilizers demands a much higher degree of aptness and care in order that they be judiciously and properly distributed. It is certain, that, in the securing of satisfactory crops, very much depends upon the evenness with which fertilizers are sown over fields. I assume, gentlemen, that you all very well know the only proper way to apply the super-phosphates and the new combinations is by broadcast sowing. This should be done after the fields designed for crops have been well pulverized and harrowed, and before rolling. I cannot too earnestly urge upon your attention this matter of the application of fertilizers. Never trust to incompetent help the sowing of the new agents any more than you would trust to them the sowing of your grass-seeds. They need to be as evenly and uniformly distributed as the seeds, and demand equal attention. Also the combination of salts must be thoroughly and evenly mixed before they are taken to the fields. Care in these regards will afford a satisfactory reward.

It is certain that the new chemical fertilizers should not

be applied as a top-dressing to grass-lands under the same conditions as barnyard-manures, as the two forms of plant-nutriment exist in the agents under widely different circumstances. Manures, or stable-dung, must undergo some important chemical changes before the active principles are formed, or before they are fitted for plant assimilation: the nitrogenous part, so important in the growth of grasses, is not really formed in manure. The elements must be grouped differently, and new combinations produced, and thus the factor of time comes in to be considered. Ammonia as such, although it holds the nitrogen, cannot be assimilated by plants: in fact, it is destructive to plant-life when brought in contact with them in concentrated form. Horse-manure in its active state of change, and charged with free ammonia, will destroy grass, if spread upon it in a still, cloudy day. With chemical salts holding nitrogen in fixed condition, either as sulphates, nitrates, or carbonates, the case is different: these are soluble forms, and readily take the next step which fits them to enter the structure of plants. As regards the other important elements of food, — the phosphoric acid and the potash, — similar conclusions may be entertained.

It is obvious, then, that, in employing the different combinations for top-dressings, we must be guided by an intelligent understanding of the nature of the agents; and this applies to time of application as well as to methods. I have had considerable experience in this matter of top-dressing grass-lands, and therefore feel competent to advise upon the subject. In the use of stable-dung we say, Apply it rather late in the autumn, but not too late; that is, do not wait until the ground freezes, but do it about a month before the usual time for the advent of severe frosts. If applied too early, as in August or September, in the northern parts of the country it dries hard in the sun, and is not so readily acted upon by frosts; and, besides, it sinks deep into the grass, and is therefore not so well distributed as it should be. The active principles have time enough to undergo chemical change from October to April or May of the succeeding year.

Concentrated fertilizers should not, under any ordinary conditions, be applied in the autumn. The reason is, that, by the rapidity of the change, the active elements of food are

brought almost immediately to the open mouths of plants, and thus by absorption they are stimulated to growth when growth is not desirable.

A plant is not benefited if it is fed just before frosts are ready to cut it down and arrest all activity. Beside this, the application of active fertilizers in the fall is attended with loss in other directions. Substances like nitrate of soda and potash, and chloride of potassium, are quite soluble; and the liquid is apt to run away if facilities are afforded. If applied to a side hill late in autumn, when a glaze of ice is possible, almost a total loss may result, if a brook receive the washings of the hills. On porous, absorptive soils the dissolved salts may sink too deep into the soil during a long winter and early spring. Our method has been to apply chemical fertilizers to grass-lands in the spring, not too early, just before growth begins. Results have been highly satisfactory in all cases. Farmers must remember never to apply nitrate of soda alone or uncombined. This salt aids greatly in the growth of the rich grasses; but, if applied by itself, it may do harm. Combine it always with good super-phosphate, and then its maximum effects are seen. We are certain that this important fact is not well understood: it is a fact learned by deduction and experience. No one of the active agents of plant-food does well alone, save, perhaps, super-phosphate, and this benefit is largely confined to root-crops. As soon as farmers understand how to use and when to use the concentrated fertilizers as top-dressings to grass-lands, these will be much more extensively employed than at present.

Chemistry has done much for the new agriculture; but in some directions it has done less than was anticipated at the period when the more exact methods and processes were first understood. It was anticipated, that, in soil analysis, chemistry would render its most distinguished aid; but such anticipations have not been realized. Soil analysis is the most uncertain and perplexing work which the chemist is called to perform; and, we may add, the practical difficulties are so great in the work, that the results are usually not very satisfactory. Let me examine these difficulties for a moment, or endeavor to bring them more directly to your attention. If a given soil is valuable from the amount of nitrogen, phosphoric acid, and potash, which it contains, it is important that

the amounts should be accurately ascertained. Now, good, arable, fertile soils will usually contain only perhaps two one-thousandths of their dry weight of the first two of these substances, and about double the quantity of potash. It is evident the fertilizing principles are present only as mere traces; but, if analysis is worth any thing, it must detect and correctly weigh them. The work must be done with the utmost accuracy, as any small fractions of error are of immense importance when the contents of a whole field are taken into account. Difficult and delicate as is the labor, it is quite within the power of the chemist to correctly determine the amounts of these agents existing in soils. If chemistry had no more difficult service to perform, we would not complain; but the condition of these elements, or their availability, is a point of great importance, and one almost or quite impossible to confidently settle. The value of a soil for growing crops depends in a great measure upon the *condition* in which the phosphoric acid, nitrogen, &c., exist in it; and, if it cannot be positively shown what that condition is, we do not obtain satisfactory results. When the chemist has estimated correctly the amount of the most important fertilizing principles in the covering of an acre of ground nine inches deep, he has acquired but a part of the information needed to enable him to give an opinion of positive value regarding its crop-bearing capabilities. There are also other points of importance connected with the physical condition of soils, which chemistry fails to shed much light upon. There can be no doubt whatever that some soils have the capabilities of appropriating more atmospheric nitrogen than others, and also the decomposition of some of the constituents of soils renders them physically better qualified to promote plant-growths at one time than at another. All these considerations should not, however, tend to destroy our confidence in the general aid which chemistry is capable of affording us: they are only calculated to make us cautious, and place a proper estimate upon the help it supplies.

Of the great light which chemistry has poured upon the structure of plants, the nature of plant-food, and sources of supply, I have not time to speak. This department of the subject has been so recently considered by me in a lecture given before a large body of practical husbandmen at

my farm in Essex County, that I pass it with less regret than I otherwise should. That address has been widely disseminated through the agricultural press recently, and therefore I presume it has come under the notice of most of the gentlemen before me.

In closing, I have but a few brief remarks to add. We live, gentlemen, in an important and responsible epoch, and the claims made upon us as studious, investigating farmers, are very great. We cannot escape the consequences of indifference or thriftless inaction in our field labors. If we neither study nor think in the prosecution of our daily duties, we shall inevitably fall so far into the rear, that the place of honor and reward, the advance line, will never be reached, and we shall share the fate of the laggard as he is presented to us in every department of industry.

Mr. Paul. I wish to ask one question before I forget it; and that is, What is the objection to applying nitrate of soda by itself? Why make the combination with phosphoric acid?

Dr. Nichols. I have always found in my own experience that I did not receive from it the results I anticipated. I do not know that I can tell precisely the reason. I only know that that has been the experience of experimenters abroad, and, as far as my knowledge extends, it has been the experience of very many in this country. We really know a great deal about the results of the new chemical fertilizers; but in justice we should certainly say that there are a great many points that we do not clearly understand. Now, in answer to the question, I may say that we have not found, and I do not believe, that you can base an accurate judgment in the use of these fertilizers upon an analysis of the plants which you are to fertilize by the use of these agents. I think that has been proved over and over and over again. I do not think that practice has proved, that, if you apply a certain amount of nitrogenous bodies to the grasses or to the cereals which contain large amounts of nitrogen, you will get the results that you might anticipate you would get. Perhaps that answers the question.

I would say here, that I think that the opinion which I gave would be corroborated by Dr. Sturtevant and other gentle-

men who have largely used the new fertilizers. I think that we have much to learn. I have found, that, in the examination of soils, we are not guided very accurately. I think, that, so far as the analysis of soils goes, we have no guidance to-day which is practicable; that is, I think that any one who should undertake to fertilize his farm upon the results of an analysis of the soil would perhaps be disappointed. It is very easy to detect the constituents of the soil, even though but a trace exists of them; but we cannot tell the condition in which they exist in the soil: therefore I think, that, in regard to the application of these new fertilizers, there is considerable yet to be learned. We must avail ourselves of all the experience of the past, and endeavor as far as we can, every year, to get new light upon this very important subject. I think, however, that experience has shown that combinations of these different substances — nitrogen, potash, and phosphoric acid — in all cases prove to be most valuable. We can modify and change them; and sometimes we shall receive satisfactory results, and sometimes we shall not.

Dr. WAKEFIELD. Will the doctor tell us why it is objectionable to apply a fertilizer at that season of the year when the plant is not in active growth, how it is lost from the fact that the plant is not in a state to take it up and use it at once, whether it is lost by evaporation, or any thing of that kind?

Dr. NICHOLS. I intended to pretty clearly define those points in the pages of the address which I read. There are several sources of loss. If we apply them too late, we are very likely, at times, to be caught by early frost and ice. If they are placed upon fields inclining towards brooks, of course they slide off into the brooks. That is one reason. Another is, that it is very possible for these soluble salts, if in retentive soils, to be carried to a low point; that is, they are sinking, and the copious rains are dissolving them, and pushing them farther down. Take a fall like this: if those fertilizers were applied before these enormous rainfalls (they are immediately soluble, you remember), they were carried down so that they are, in a measure, beyond the reach of the roots of some plants.

Capt. MOORE. Perhaps Dr. Sturtevant can tell you something about fertilizers sinking into the earth.

Dr. Sturtevant. I am very willing to give you a little information here, as I probably have the only lycimeter, or differential rain-gauge, in New England that has been run long enough to furnish any results. There are but three in the United States, — one in New York, and two in Massachusetts. I have run one for two years; so that I can speak with some definiteness. A differential rain-gauge, or "lycimeter" as it is called in the language of science, is a box of earth about a yard square, and twenty-five inches deep, so arranged that all the water that falls upon the surface and passes through that earth is collected underneath: in other words, it is a rain-gauge which measures the drainage of the water through the land. Its value is in giving us a reply to this very question which has been put as to the passage of manures through our land. The manures we use, either dung or chemical fertilizers, are not lost, except through leaching and change of form: they are not lost through evaporation. I am speaking of agricultural loss. There may be some small exception to what I say; but, agriculturally speaking, the only loss which occurs to our manurial applications is through leaching down through the land below the reach of the roots, and from their change of form, by which they become unfitted for plant-food. But this is the point I wish to bring out, — that, in the climate of New England, on my soil (which is lighter than will be found in many other localities, and therefore the results which I get there are applicable, probably, to nine-tenths of the soil in this State), there is absolutely no loss of fertilizing substances during the season of growth. I think that replies to the question, and furnishes some facts.

Now, we can apply nitrate of soda, even a chemical salt, which is so diffusable in the soil that it will pass through the soil as water passes through a sieve, — we can use nitrate of soda on our crops during the season of growth, without any loss: in England they cannot, because there is water passing through the soil during the season of growth. We can use our fertilizers, applying them in the spring, when growth has commenced (I am speaking agriculturally now, not taking exceptional cases, but simply taking it generally speaking for New England), — we can apply dung or chemical fertilizers without any danger of loss through leaching during

the season of growth. If we apply manure in the fall, we then have a loss through leaching, because during the fall and winter, on account of evaporation being checked by the lowness of temperature and by the foliage of the plants not respiring (being in a dead, inert state), we have a passage of the water through our soil; so that there is a loss during the winter season of the fertilizing constituents.

During the warm and evaporating time, in summer, two feet of surface-soil of the ordinary character will dispose of seven or eight inches of rainfall, without showing any drainage in leaching. During the winter or late fall, when evaporation is not as great, the soil will not hold more than three or four inches, sometimes even less. So that you see now a real reason for the doctor's advice to apply fertilizers or dung in the spring; or, if you apply them in the winter, apply them after the land is frozen, and in those climates where the land does not open during the winter. The number of inches varies with the temperature; it varies with the wind, with the quantity of water in the soil from previous rains, and from various other circumstances. I simply state that oftentimes the two feet of soil will contain or dispose of seven or eight inches of rainfall, while at other times that same soil will not contain more than two or three inches of rainfall; the difference being brought about by the difference of the evaporation between summer and winter, and because in winter we have no respiration from the plants, which we have largely in summer.

Dr. WAKEFIELD. I will ask the doctor if he finds any constituents of fertilizers applied in the growing season in the water leached through below where the roots of any given crop would go.

Dr. STURTEVANT. I will only say that that opens the whole question under discussion of the use of fertilizers, and that question cannot be answered without bringing in a great deal of collateral information. The elements of fertility which concern us as farmers are but three in number,— nitrogen, phosphoric acid, and potash. These are acted upon by the soil differently, and are acted upon differently by different soils; and while phosphoric acid and potash, speaking agriculturally, never leach from the soil, and sulphate of ammonia applied to the soil leaches but very slowly,

nitrate of soda leaches very readily indeed. We can only say that about it. Moreover, we can say that every particle of nitrogen which runs through the soil, agriculturally speaking, passes through as nitric acid: the plant feeds upon nitric acid, and not upon ammonia, and it is only through a series of changes that we get plant-food to our plants.

I may also say what was stated by Liebig in 1842 (the date, I think, of his first edition), which has been overlooked largely in our discussions, and yet it is one of the most important statements ever made concerning rational agriculture; and that is, that it is not so much the amount of fertilizing elements in the soil which concerns us as farmers as it is the condition of saturation of the soil. To illustrate this statement: If I had a box of earth, and on the top of this box I placed super-phosphate, containing soluble phosphoric acid, and then poured water upon that, and then allowed the water to leach and pass out below, you would find that the water which was still put on would carry this phosphoric acid down into the soil until that phosphoric acid (and here is the point) was evenly diffused, so that every single particle of soil held the same quantity of phosphoric acid, just as far as that water could pass down; and, when that took place, then the extra water poured on would simply pass through as water, taking out none of the fertilizing elements. If, having your phosphoric acid evenly diffused and distributed through the soil, you apply more phosphoric acid and more water, your phosphoric acid passes down an additional depth in that soil; and, agriculturally speaking, it is this saturation of the soil which concerns us more than the quantity of manure. So that, although we may have the material for five hundred crops in our soil, yet it may happen that we cannot get, agriculturally, a crop from that soil; and yet the addition of only enough material for one, two, or three crops, may give us large crops. Just that little addition which adds enough to the immense sources of fertility in the soil to bring those sources up to the point of saturation will make all the difference between no crop and a large crop. Does not that meet your views, Dr. Nichols?

Dr. Nichols. Yes, sir.

Mr. Whitaker. Would not the character of the soil make some difference?

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Dr. STURTEVANT. Generally speaking. I am speaking of agricultural soil.

Mr. WHITAKER. Would not soil which contained a large amount of vegetable matter be more likely to retain the minerals that you placed in it than soil that contained less vegetable matter?

Dr. STURTEVANT. I don't want to open that matter. It will open up too extended a discussion. I don't want to give any half truths.

Mr. WHITAKER. My experience is this, that if you take clear sand, and try to pass water impregnated with foreign substances through it, a large portion of it will be very likely to pass through the sand; if that sand is mixed with ashes or clay, it will not pass through so fast; if that sand and clay are mixed, say with very fine charcoal, or some other vegetable partly decomposed, or decomposed almost to become carbon, that will help to retain the water: so that the passage of the water really depends in great measure on the condition of the soil. Now, I will tell you how every one of you can try this experiment for yourselves, without having to go back to any one. Just take a champagne bottle, if you like, or any other bottle; invert that, and break the bottom off; fill it with sand within an inch or two of the top; and then put in your liquid, and see how it gets out of the bottom. Then make a mixture of clay and sand, and pour on your liquid in the same way; then make another mixture with very finely powdered charcoal, and try the same experiment. You will thus find how different soils will leach. It is a simple experiment, and one that you can all test; and we shall find, as a general thing, that we learn fully as much from plain, simple experiments as we do from larger laboratories, and they make an impression on our minds. You will find that the mixture put into the bottle that contains charcoal allows the least water to pass through; that which has the clay comes next; and the sand allows it to pass off rather freely. So we are met in agriculture everywhere with a great many circumstances which modify our opinions.

Now, I should like to ask Dr. Nichols one question. He says that a horse that is worked to a considerable extent will void less nitrogenous and fertilizing matter in its excre-

ments than one that is worked but little, because more is required to build up the bones and muscles of one animal than of the other. Now, I admit that. But there is another little query comes in there, and I should like to have the doctor explain it a little more fully. If we work a horse, we wear down the tissues, we wear down the bone material to some extent, wé wear down the sinews to some extent. What becomes of the material that constituted the bone, the muscle, and the sinew, that is worn down by labor? Does not that pass into the excrements, to be thrown off with them? Would not the urine of the hard-worked horse have a little more ammonia in it than that of a horse that is standing still in the stable?

Dr. NICHOLS. It might possibly.

Mr. WHITAKER. We may lose some of it in the road; but, if we could use that horse where we could save all the excrement that came from it, we should find that we had just about the same amount from the hard-working horse that we had from the stall-fed one that is not worked. There is nothing lost. We can change it and modify it in various ways; but we cannot destroy a single particle.

Now, there is another point with regard to the fertilization of grass-land. It is generally said, that, if you spread manure on a side-hill in the fall of the year, you will lose it all before spring. I have spread manure on grass-land on a very steep hill, and at the foot of the hill there is a basin into which the water from the hill comes; and I have failed to detect any of the elements of manure, or urine, or any thing else that was put on that grass-land, in the water in the basin. I have found, that in coming down the hill, and coming through the grass, the fertilizing material filters in, and is left on the side-hill, and that I do not lose my fertilizing matter by placing it on that hillside. I have tested that water a great many times, and have tried it in various ways, and have failed to find it impregnated at all with the manure that was put on the hill.

Dr. NICHOLS. I wish to say that the experience of Mr. Whitaker differs from my own experience, and perhaps it differs from that of others. I have not failed to find the valuable salts in the water which flowed from fields to which those salts have been applied; and this is especially so in

the case of manure applied late in the fall; and I think there can be no question that it is a wasteful procedure to apply manure, or any fertilizing agent, quite late in the fall. Two years ago I applied some manure to a field about ten rods above the road, to which the descent was very gentle. I found, that, after every copious rain, there were puddles of water in this road, which led me to secure some of that for chemical examination. I was astonished to find the amount of soluble salts which had been taken up and carried away, together, in this case, with some of the carbonaceous matter connected with the manure. I do really think that we must use good judgment in the distribution of manures; and I think there can be no question about the impropriety of spreading them late in the fall upon fields that have a gradual or a precipitous descent.

Mr. PAUL. I wish to ask the doctor one question. I have practised for many years applying my stable-manure in the fall to land that is to be used for hoed crops the succeeding year, and ploughing it in very shallow, say some three inches or thereabouts. What would you say to that practice on comparatively level land?

Dr. NICHOLS. It is a very good practice indeed. You are enabled to do in the autumn work which you have not really time to do in the spring.

Mr. PAUL. That is why I have done it.

QUESTION. Is there not a loss of fertilizing material?

Dr. NICHOLS. I should not say so under those circumstances.

Mr. PAUL. I would say that I again plough in the spring five or six inches deep.

Dr. NICHOLS. The condition in which these fertilizing elements exist in the manure is a very interesting one. I did not feel that I could introduce it in my address, because it would require too much time to discuss it. We frequently meet with disappointment in the application of barnyard-dung, and we are greatly puzzled to know why we meet with these disappointments. I would say, in general, that barnyard-manure, as it exists in the heaps connected with our farm-buildings, is generally very far from being in the right condition to be applied to the best advantage. You must allow your manures time to undergo a process of fer-

mentation before you can get benefit from them. They must undergo what is called the putrefying change, and there is a round of chemical changes which fits the manure to feed the plant. If you apply raw manure in the fall, those changes during the cold weather are very slow: in fact, they are almost entirely suspended in very cold weather; but in the spring, when warm weather commences, those changes go on. There is one very curious fact, which, at the time of the investigation of it, astonished me more than almost any thing else (I don't know but a great many others have made the same investigation, and reached the same result; but I will venture to give a little statement of my experience): that fact is, that, through a wise purpose, the soil has the power of attracting to itself these agencies. We do not lose as much by gaseous decomposition, which passes off, as we imagine. I found several years ago, by a series of interesting experiments, that there is in mother earth a very strange attraction for these principles which are volatile. I am quite prepared to say that a mass of manure undergoing putrefactive change, which results in the formation of those bodies which are assimilable, may stand above ground without any special loss. It is found that the attraction is downwards, not upwards. A very interesting fact, indeed: it accounts for a great many things, and it shows the wisdom of some power which is beyond us in this direction. We do not lose so much by the winds, the currents, &c., as we imagine, because there is in the soil a certain power, I do not know what to call it, by which these fertilizing elements are attracted downwards: it is natural, and that is about all we can say in regard to it. So that when you spread manure upon a field in the spring, when warm weather is coming on, these changes are pretty prompt. The promptness with which these changes take place depends upon moisture and warmth; and you must have moisture and warmth, or else the changes will never take place, and your manure would be inert; but when these changes do take place, even if the manure is above ground, the loss is very much less than, I think, our farmers generally suppose.

Mr. Flint. Dr. Nichols has taken occasion to allude to our Indian corn, and to its value as compared to Western and Southern corn. Now, it so happens that there are careful

scientific investigations in progress at the Agricultural College, which will eventually, I think, throw great light upon that subject. I am sure you would be glad to have Professor Goessmann make a statement of the objects of that investigation, what progress has already been made, and what results may be anticipated from it.

Professor GOESSMANN. My experiments have not progressed very far. I have been collecting samples from different sections of the country, North, South, and West; and I have selected from the various specimens six varieties for special investigation. I have so far tested in reference to the mineral constituents of the corn as well as of the cobs. In regard to the investigation of the cobs, I have arrived at some conclusions which warrant me in saying that the results will be in favor of the use of cobs for feeding purposes, as the percentage of phosphoric acid compares well with our common straws and second-quality hay. I have also ascertained the mineral constituents of most of the specimens of corn. I find a considerable difference in regard to phosphoric acid in corn from different localities and in different kinds of corn; and if the opinion entertained by agricultural chemists is true, that there exists a certain relation between the percentage of phosphoric acid and nitrogenous matter in grains, there is reason to assume that the nitrogenous matter will also vary in a considerable degree; but as the carbonaceous matters, starch and fat, vary also, an increased amount of those constituents may, to some extent, compensate for a less amount of nitrogenous matter. It is difficult to decide at the present time, which will come out as the most valuable one for feeding purposes. Our recent investigations in regard to the application of food tell us that the value of the food does not solely depend upon more or less of one constituent, even the nitrogenous matter, but the relative proportion, the exact proportion, and the different conditions, of even the same animal, young or old, working or unproductive.

The examination of these various specimens of corn has been undertaken for the purpose of having the results obtained by one party applying the current improved modes of investigation. Although there is much material already on record in regard to the composition of both corn and

cobs, yet these results have been obtained at different times and by different parties, and therefore have no comparative value, because our modes of inquiry are still imperfect, and success depends a great deal upon the skill of the investigator.

There has been some discussion here to-day in regard to the effect of the use of nitrate of soda, to which I wish to add a few facts which may be of interest; for the importance of nitrate of soda as a source of nitrogen for plant-growth is daily more recognized in Europe as well as in this country; nitrate of soda furnishing nitrogen in the best form for assimilation, at least so far as actual experiments demonstrate; and, besides being a plant-feeder, it is a distributer of plant-food, it aids in the diffusion of other articles of plant-food through the body of the soil. An instance of that kind came lately under my observation in a case where several hundred pounds of super-phosphate had been applied to the soil. The drainage was tested, coming from that soil afterwards, and it showed no trace of phosphoric acid: in other words, the phosphoric acid had been entirely retained. But in treating the same soil subsequently with nitrate of soda, and repeating the test in regard to the drainage-waters passing through, I found phosphoric acid in the drainage-waters. For these reasons, chemists are in the habit of calling it a chemical plough doing the mechanical work.

I take the liberty of referring to the question discussed of chemical fertilizers, and their action on the soil. There is, undoubtedly, a specific action of agricultural soil in various descriptions of chemical fertilizers, modifying their composition, and controlling to a large degree their action. If it is to be recognized as an established fact that the form in which plant-food is presented for the absorption of soil affects the growth of the plant, it is of the utmost importance to know what changes a fertilizer undergoes by being mixed with the soil. Changes are taking place which no inspection on general chemical principles would entitle us to assume. To illustrate this point, I will state two observations of my own. I took, in one case, sulphate of lime (common gypsum), and brought it in contact with magnesia limestone, or dolomitic limestone, frequently found in our soils as a detritus, broken up, and placed this mixture

under the influence of carbonic acid. The object of this experiment was to bring gypsum and magnesia compounds under common influences in the soil; for every agricultural soil contains organic matter, which, by gradual decomposition, becomes a constant source of carbonic acid. In testing the washings of this mixture, some time afterwards, I found that in the solution was sulphate of magnesium: in other words, the sulphuric acid of the gypsum had passed under the influence of the carbonic acid of the magnesium, and formed sulphate of magnesia (common Epsom-salt), while the lime combined with the carbonic acid, and formed common carbonate of lime, which was mixed up with the soil in an insoluble form.

The second experiment was carried out in the following way: Sulphate of lime, carbonate of magnesia, and common salt (sodium chloride) were mixed, and placed under the influence of carbonic acid, to learn whether common salt suffered any transformation which might aid in the explanation of a good many of the good results, as well as the failures, from the application of common salt as a fertilizer; and a critical examination of the washings proved that the chlorine of the sodium had passed over to the magnesium, and formed chloride of magnesium, a compound well known as injurious to plant-growth; the sulphuric acid of the gypsum had passed over to the sodium, and formed common sulphate of soda, or Glauber's-salt; and the lime was left as carbonate of lime. Therefore, before you draw a conclusion from a single experiment, repeat the experiment.

Mr. Flint. Dr. Nichols, in speaking of top-dressing with barnyard manures or compost, advised that they should be put on in the fall, not too early, and not at a time when they would produce late growth. Possibly I have not very clearly stated his point; but I think he overlooked, no doubt quite inadvertently, the fact that a growth, no matter what time in the fall it takes place, is a growth which is a permanent advantage to the plant itself. It must be borne in mind that the root-power of a plant is very much in proportion to the surface or the leaf-power. If the leaf is small, the root will be small; that is, you will get but a small plant-root in which to store up the rich materials for the use of the plant early in the spring. Now, any thing, it

seems to me, which encourages a rank, strong, and vigorous growth of the plant on the surface, in the way of leaf, also implies a strong and vigorous root-power, and the root continues to grow while the ground is unfrozen. I suppose the roots of our grasses and of our perennial plants continue to increase in size and vigor until the ground actually freezes up; so that the fall growth, no matter whether it is just before freezing up or not, implies also a constantly-increasing root-power; and it is that root-power that we want in our soil, not only for the purpose of a more vigorous and earlier start in the spring, but for the sake of laying up a large quantity of organic matter which will be of permanent influence in increasing the fertility of our land.

Mr. SLADE. How is it about applying manure in the fall for a crop to be put in the next spring?

Mr. FLINT. My opinion corresponds with that of Dr. Nichols, so far as regards applying the coarser barnyard-manures and stable-manures for spring use. Every farmer knows perfectly well that all our coarser manures must undergo the process of fermentation or decay: that takes time; and, if they are applied early in the fall, they will go through, either partially or pretty completely, the process of fermentation, so that their materials are fitted for use by plants early in the spring. And if a farmer were designing to plant a field of corn in the spring, and to use only stable-manures, I suppose he would get better results, if his land is ordinarily level, and with a medium retentive soil, by applying his coarser manures in the fall than by applying them in the spring. If the land is sloping, and subject to great drainage, of course that is another thing.

Mr. CUSHING. I came from Boston to this town about 1849 or 1850, on to the farm that my father had formerly owned. He was a good farmer, and raised good crops on it; but the farm had been let out at the halves, and it had been run down. There was one piece of about three acres of grass, divided into three fields; and, when that grass was put up at auction, they could not get seventy-five cents a field for it. I have kept that field on purpose so that I could tell from practical experience what top-dressing will do. I have made all my own manure on the farm, except two or three years. I cannot get on to that land to top-dress it until it

begins to freeze nights and mornings, and it has not been ploughed since 1821. I have top-dressed it with all kinds of manure and I get two good crops off of that land every year, — two tons and a half to the acre for the first crop, and one ton the second, — and turn my cows in afterwards. I top-dress it with coarse manure at any time between November and March, and sometimes in May, when I can get on to it. I do not think we try experiments long enough. If a man would come and tell us how he made a complete failure, he would do more good than by telling us of fifty successful experiments. If we will gather up the leaves in the woods, mow our bushes, and take care of all the waste materials about the house and barn, we can make all the manure necessary to carry on farming well.

Capt. MOORE. I will speak of one point to which Dr. Nichols referred, and which has since been alluded to by Mr. Flint; and that is, upon the application of manure in the fall. Dr. Nichols says, that, to have manure formed into plant-food, you must have putrefaction, and Mr. Flint says about the same thing. How are you going to get putrefaction when you apply it late in the fall, when it is cold? Is it not a fact patent to every farmer, that if he ploughs a piece of sod-land in the fall, and ploughs another piece in May, the sod that is turned under in May rots quicker than that which is turned under in the fall? If that is so, if the manure is applied in the spring, and the sod turned in the spring, you get putrefaction quicker, and that is what rots the sod: you make your plant quicker, and you do not run the risk of loss. Therefore it seems to me that it is better to apply manure in the spring rather than in the fall.

Mr. FLINT. In May than in September?

Capt. MOORE. Well, you may, if you plough in September, have the sod as rotten the next August as sod ploughed in May.

Mr. FLINT. My experience has been, that, on many soils, the sod ploughed in September will be very much decayed by May.

Capt. MOORE. The way that this was put to the meeting was, "in the fall," and I think it was distinctly stated so: "Apply your manure in the fall, before the ground freezes." I don't believe that is the best way. I believe you run the

risk of loss, if you put your manure on the top of a piece of land in the fall. If there comes a heavy rain, you will find puddles there, and the water will be impregnated with the manure. If that is not so, will you tell why the lowlands are richer than the uplands?

Dr. STURTEVANT. The wash from the uplands deposits fine mud, a clay-like substance called "silt," in the lowlands, and makes them richer.

Capt. MOORE. There is not a farmer in this room who has not seen the water by the side of the road discolored by the wash from coarse, crude manure applied in the fall. It seems utterly absurd to me to say that no wash comes from manure when applied in the fall. I may be all wrong; I may be thick-headed: but I believe you will convert your manure into plant-food quicker, and make it more available for the plant that is going to take it up, by applying it in the spring than if it is applied in the fall.

Mr. WHITAKER. There is one thing that Capt. Moore has called attention to in reference to the advantage of turning over the sod in May as compared with turning it over late in the fall. He says that we get more available food for the plant from sod ploughed in May than we do from sod ploughed late in the fall. Probably there is a great difference in the meaning of the term "late in the fall." Last December, after I had been over to the Waltham meeting, I went home and ploughed under part of a piece of sod-land upon which I was going to plant some fodder-corn early in the spring. The latter part of April or the early part of May I ploughed under the other part. I manured both lots alike: they lay contiguous to each other. I planted my seed for fodder-corn, and the results were not good on the part that was ploughed in December. I made up my mind I would not do it again. On that part which I ploughed in May I planted fodder-corn after I was at Dr. Sturtevant's meeting, which was held, I believe, on the eighteenth day of July. I went home and planted more corn on that (I had planted some previously), and that was the best success I ever had with fodder-corn. But not to be beaten out of it because I had made a mistake in December, and got a poor crop of fodder-corn in June, I ploughed that up, put on a little more manure, and sowed with barley, and on the fourth day of

November I had as nice a piece of barley as ever you saw growing, just as green as it was possible to be; and I was feeding my cows green barley for fodder from that piece of ground. But actually I can say, that, on the piece ploughed in May, the sod was better rotted when I ploughed it up the first of October and put in winter rye, than the other sod was when I ploughed it up and put in barley. That is my experience within a few days.

Another thing in regard to applying manure late in the fall. The question is, How late in the fall? Dr. Nichols said, if you apply it in August or September, it will be very likely to dry up; that is, taking it for granted that it goes up. With all due modesty, I beg leave to differ from the doctor in that.

Mr. FLINT. If you will excuse me one moment, I did not understand Dr. Nichols exactly so. Possibly you are right; but the way I understood him was this, — that the objection to applying it so early was, that the grass would grow up about it, and prevent its uniform diffusion over the soil, not that it would be lost by evaporation.

Mr. WHITAKER. If that is so, I stand corrected. Of course, Dr. Nichols's address will be published, and then we shall have it just as he gave it. But I had that idea about it, and it struck me very forcibly that applying manure in the fall is like feeding animals when they do not want to be fed. I believe in feeding every thing when it wants to be fed, whether vegetable or animal: that is the time to feed with the best results. Now, what I was going to say in regard to applying manure late in the fall was this: if you apply manure just before it freezes, it will neither go up nor down. If it goes any way, it will go up by mechanical action, not by washing down, because the ground is frozen up. It will stay there: that is one reason why I should not hesitate to put on manure any time when the ground is frozen. And while I admit that manure will wash, and wash very materially, on side-hills where there is no grass, it will not wash where there is grass to retain it. Thirty or forty years ago, when I went through the barns of farmers, I used to wonder at their want of common sense in allowing the best part of their material to be washed into streams, and finally buried in the ocean, and then sending vessels over the surface of the

ocean to the guano islands to bring back guano to take the place of the manure that they had allowed to wash away. I would not apply manure to the surface of the ground where there was much declivity until I wanted to plough it in. But, as I said before, I tried it on a side-hill where there was grass, because my neighbors said, if I put manure there, it would all run down. Well, at the foot of the hill there was the basin to which I have referred; and my cows went to this basin to drink rather than go to the spring, which was a little farther off. I have a very good opinion of a cow as to her taste, when let alone. A cow will not drink water when there is the slightest smell of manure in it, unless she is compelled to; and my cows would go to that basin to drink rather than go to the spring a little distance off. That was evidence to my mind that the manure was not washed down into the basin.

Since I tried that experiment, Dr. Sturtevant has published an account of a very similar experiment, where trenches were dug in order to stop the water as it ran down in different places; and it was found that the first trench did catch some of the fertilizing water, the next had less, and so on until it got to the bottom. I recollect being in Dr. Sturtevant's office, and making this statement of the purification of the water as it came down hill, by reason of the fertilizing material being left behind in the grass, and he then showed me the experiment I have just mentioned, which had been made by another person, but which he described in "The Scientific Farmer."

But do not understand me as advocating putting manure in the fall on to land that has a declivity that has been ploughed. I would not plough it in the fall if I could help it, or, if I did plough it, I would put in something that would hold the fertilizing material, because we lose a great deal of fertilizing matter from our side-hills. I think we lose most in winter time; that is, if we have a thaw and a heavy rain-fall, or a rapid thawing of snow, it will take off just about half an inch or an inch of surface, and the best part of your land goes with that half-inch or inch. There is not so much danger where you have a good covering of grass. I suppose it would filter better if you had three inches of grass than if you had but one.

Mr. Hadwen. My practice is, as I have stated before at a meeting of the Board of Agriculture, to spread my manure immediately after it is made, provided it is convenient to do so; and that manure is spread upon the tops of furrows. During the winter, every day, or nearly so, the manure is taken from my barn-cellar, and spread upon a field ploughed in the autumn for the purpose. So far as my observation has gone, I get better results from such procedure than by letting it remain in the barn-cellar, and taking it out in the spring, which I have been formerly accustomed to do. The facts are these. There is never any more to manure than when it first comes from the animal. If it is placed immediately upon the soil, all the soluble portions are taken up by the soil; and the insoluble portions, by the action of the atmosphere and rain, become suitable food for plants sooner than they will if they remain in your barn-cellar.

Now, the question comes in relation to the economy of this practice. Every one knows that manure can be handled in the winter season at less expense than in the spring, and my experience has proved that I obtain better crops when the manure is placed on the land in the winter than when it is applied late in the spring. I had a practical demonstration of that on a corn-field this last season. The field was on rolling land; and, in order to prevent the little wash which we all know will take place, the upper portions of the field, and, in fact, all the field but the immediate lower portions, were top-dressed in the winter. The lower portion, which was not wider than two rods, was top-dressed in the spring just previous to planting. The crop could be noticed by any one where it was top-dressed in the winter; and, in fact, the best corn was raised where it was top-dressed earliest in the winter. One end of the field was devoted to cabbages, and with like results.

Mr. Smith (of Colrain). Are we to understand that Mr. Hadwen puts his manure on the land after it is ploughed?

Mr. Hadwen. Certainly.

Mr. Smith. At the last meeting of the Board it was stated that if we spread manure directly from the stable upon the land in winter, even if it is freezing cold, when we plough that land in the spring, the sod will be so nearly decomposed, that it will turn up as mellow as though it had

been ploughed the year previous. Now, all these things I have thought of, and I have told them to my brother farmers, and I believe a great many of them are going to try the experiment. Now, if that has been tried and found wanting, I want to go back and right it.

Mr. CHEEVER (of Sheldonville). I never fear to put manure on the top of the ground in the fall or winter, or any time of year. I have frequently put manure on grass-land covered with snow in winter, and on frozen ground when there was no snow; and, not finishing the whole field in winter, I have completed the work in the spring, with the same kind of manure, and I have never been able to see any practical difference in the amount of crop grown on that portion manured in the winter and that portion finished up in the spring. But what I was going to state is a fact without any theory: I leave that to you. Last winter I top-dressed a grass-field heavily on the snow. Across that field was a low depression; and the wash from above, caused by the melting snows, was turned into one channel and swept over a piece three rods wide. After the manure had been spread, and partly incorporated with the snow, there came on just such a thaw as I do not like to see after I have got manure spread. The snow went off in twenty-four hours; and the accumulated wash from the field above, that had not been top-dressed, pure snow-water, came down across this field, and actually washed the manure off clean for two or three rods across that field; and, when I went to look at it, my manure was not there; it had washed down into the meadow below. The meadow was flooded, and the water was colored, and smelt like water from a barnyard. In mowing this summer, the grass was quite as good where the manure was all washed off as it was anywhere else. That is the nut I want somebody to crack.

Dr. WAKEFIELD. I don't belong to that class of mules that will not eat at either stack; but I go to one stack, and, if I don't like that, I go to the other. I recollect the discussion a year ago, and I gave there my experience. I used to be afraid to put my manure on top of the ground (I was afraid of evaporation, I was afraid of leaching): I wanted to wait until the time came for the plant to grow, when every thing conspired with Nature to send it forward imme-

diately. But I have learned, I think, by experience, better than that. As the gentleman from Worcester (Mr. Hadwen) says, there is no time when the manure is so valuable as it is immediately on coming from the animal. If that is so, then, the sooner you can get this manure into the ground or on to the ground, the better. It has been stated here, and I have no doubt of it, that there is a great tendency in the land to take the fertilizing elements of the manure down; that it has an affinity for them, and will take them. Now, my experience has been this. Since I lost my fears of evaporation and leaching, I have spread my manure in winter, sometimes without ploughing, and sometimes with; but I am satisfied that it is better to put it on at that time than it is to put it on in the spring of the year, because you get just as much benefit from it, and you have the economy in your favor. You do it at a time when you can do it a great deal cheaper than you can in the spring when you are hurried. It seems to me there can be no question, that, on an inclined plane, a steep side-hill, there is liability to wash. I can believe that, although I cannot believe that the gentleman's statement, that the crop was just as good where the manure was washed off as it was where it did not wash, was precisely true. It seems to me, that, where you have a side-hill so steep that you must have washing, you must lose some of your manure. My experience is, that, when I manure a side-hill, the ground below, although there is no manure put there, will show the effects of the manure applied to the land above, plainly showing that it has gone down.

Mr. HADWEN. For how great a distance?

Dr. WAKEFIELD. I cannot say by rods; but you can see traces of it for some distance.

Mr. HADWEN. As far as the water flows?

Dr. WAKEFIELD. I don't know about that. If it flowed a great distance, I am inclined to think it would lose its effect. My idea is, that manure should be put on at the time when it is most convenient, and when, under all the circumstances (if it is early in the summer), we think it is as good a time as we shall have in the course of the year. I believe there is such an affinity of the earth for the manure, for those fertilizers which go to make up plants, that it will take

them down. Now, if rain comes gently, like the dew, it does not wash the manure, but saturates it, and it will all go into the land where it lies, even if it is a side-hill; but, if you have such a rain as we had yesterday and last night, it will take it off of places even on level ground. There is no ground so level but there will be gullies in it; and if such a rain as we had yesterday comes, and there is nothing to prevent, it will carry it into the streams, and it will be lost. We cannot guard against such losses; but we must exercise the best judgment we have, and apply our manure at such time as suits our convenience, unless the ground is too steep, so that there is every reason to believe that a heavy rain will take it off, in which case, it would not be wise to put it on in winter. But my experience is, that you can top-dress at any time without danger of severe loss; and you need not fear to put it on at such times as you can do it economically, lest you should lose it, either by evaporation or leaching.

Adjourned to evening.

Evening Session.

The evening session was called to order at half-past seven o'clock by Mr. Hersey, who, on introducing the lecturer of the evening, said, —

Ladies and Gentlemen, — It is well known abroad, if not at home, that Massachusetts has one of the best agricultural colleges in the country. This is known in foreign lands. The Government of Japan understand it; and several years ago they sent here, and secured the services of the president of that college to go there and found a similar institution in that country. It was while there, in the performance of that duty, that he became acquainted with the agriculture of Japan. He has very kindly consented to appear before us to-night, and speak on that subject. I have now the great pleasure of introducing to you Col. William S. Clark, president of the Agricultural College of this State.

THE AGRICULTURE OF JAPAN.

BY WILLIAM S. CLARK, PRESIDENT MASSACHUSETTS AGRICULTURAL COLLEGE.

Dai Nippon, Great Japan, was but a few years ago one of the most unknown and inaccessible countries of the far-off Orient. To-day, thanks to American enterprise, this "Land of the Rising Sun" has become our next-door neighbor on the *west;* and the progress which her people have made in the last ten years in their political, educational, and industrial affairs, has never before been equalled, either in history or romance. Your attention is invited this evening to a few facts concerning the situation, extent, and resources of this country, the characteristics and condition of its inhabitants, and especially of its farmers, and the peculiarities and results of its ancient system of agriculture.

The Empire of Japan consists of nearly four thousand islands, which constitute the western boundary of the Northern Pacific Ocean: they extend nearly two thousand miles in a south-westerly direction from the peninsula of Kamtschatka, lying mostly between the fiftieth and the thirtieth parallels of north latitude. They are separated from the continent of Asia by the Japan Sea, which varies in width from one hundred to three hundred miles. Among all these islands, only half a dozen are of any consequence, most of them consisting of barren rocks, which are largely of volcanic origin. The total area of the land is about a hundred and fifty thousand square miles, a large part of which is found on the great island of Hondo. This island the Japanese call the mainland, and on our maps it is named Niphon. It is nine hundred miles long, and its extreme width is two hundred and forty miles. The interior portions of Hondo are mountainous, and have an elevation of from three thousand to twelve thousand feet. The highest peak and the most famous mountain of Japan is a volcanic cone of lava resting on granite, whose snow-clad summit looms up before the traveller as he enters the bay of Yeddo. A recent author says, "Perhaps no view is so perfect, so impressive for a lifetime, so well fitted to inspire that intense appreciation of Nature's masterpieces, whose glory and freshness we can feel intensely but once, as is the view of Fuji from an

incoming steamer." Every Japanese desires to make at least one pilgrimage to this magnificent mountain, a representation of which is one of the most familiar features of Japanese art. In the south of Hondo, mountains of eruptive granite rise abruptly along the coast, constituting to a considerable extent the characteristic scenery of the charming Inland Sea. These summits are sometimes of durable rock, furnishing excellent building-stone, and usually covered with perennial verdure. Sometimes, on the contrary, the granite readily decomposes, so as to form ridges and rounded hill-tops of loose, white, barren *débris*, from which the fertilizing elements have been washed into the luxuriant valleys below. Here are the most wealthy and renowned of Japanese cities, surrounded by the finest and most productive fields to be seen in the world. Saikio, the Jerusalem of Dai Nippon, celebrated for its magnificent temples and monuments, its manufactures of silk, and its beautiful women, was for many centuries the sacred city of the Mikado. Seven miles to the north lies the great lake Biwa, sixty miles in length, which, with its numerous steamers, furnishes admirable means of communication with the interior. Twenty miles to the south, at the head of the Inland Sea, is the old commercial metropolis of the empire, Ozaka. This is the Venice of the East, intersected in all parts by canals, and containing a population of half a million. It is said that five hundred junks and other vessels, from all parts of the country and from abroad, enter this port every day. An excellent railroad, forty miles long, connects Ozaka with Saikio on the one side, and Hiogo on the other. The population of the level region along this railroad is not less than three millions.

The climate of Japan is exceedingly favorable to both animal and vegetable life. There is everywhere abundant moisture and plenty of sunshine. The air is pure and in constant motion, since both land and sea breezes exert their benign, health-giving influences, while an occasional typhoon perfects the national system of ventilation. The Black Stream, a warm oceanic current flowing northward along the eastern coast of the islands, greatly moderates the winter temperature, and prevents severe and untimely frosts. On the west coast, north of the thirty-fifth parallel, there is an abundance of snow, though the cold is never intense.

The mineral resources of Japan are abundant and various, though the arts of mining and metallurgy are still in a primitive condition. There are extensive beds of excellent bituminous coal on the larger islands, while there is an adequate supply of iron, gold, silver, quicksilver, tin, copper, lead, zinc, antimony, manganese, arsenic, and sulphur, in various portions of the empire. Petroleum has been found in several localities; and there are valuable deposits of plumbago, salt, and kaolin, as well as of gypsum, soapstone, and marble. Immense quantities of gold, silver, and copper, have been exported from the country; the Portuguese and Dutch having carried away five hundred million dollars in precious metals between the years 1550 and 1650, besides an enormous amount of copper, which is still produced in abundance, and of superior quality.

The soil of Dai Nippon, as of other countries, is variable in quality; but that which is under cultivation is generally of unusual natural fertility. This results from the fact that luxuriant vegetation furnishes plenty of organic matter in the uncropped fields and forests, while the heavy rains and mountain-torrents are constantly bringing from the interior highlands the finer and richer particles of the soil, and depositing them in the valleys which extend downward to the sea. Under the ancient system of cultivation, only such lands are highly esteemed as are capable of irrigation, without which rice, the principal cereal, cannot be profitably produced.

The Japanese people are a peculiar and remarkable race, whose origin and early history are involved in obscurity. They are more vivacious, progressive, and courageous than the Chinese, and have a language quite their own. They have a high sense of honor, are exceedingly polite and amiable, and intensely patriotic. They are apt scholars, ingenious artisans, successful farmers, excellent sailors, and brave soldiers. They seem to combine in their national characteristics the good qualities of the active, merry Malay of the South with the intelligence and conservatism of the Chinese, and the substantial physique and Aryan features of the Ainos. This union of several unlike races under favorable conditions has resulted in the production of a people superior to any of their progenitors. As might be expected, there is

much diversity among them in the form and expression of the features, the amount and kind of hair and beard, and in complexion, which varies from white to a very dark yellowish-brown.

The first settlers, or aborigines, of Japan, seem to have come from Central Asia, by way of the great northern island of Saghalien, which is separated from Siberia only by a few miles of shallow water. There is satisfactory evidence, in the ancient kitchen-heaps of this race on the island of Hondo, as well as in the traditions of the people, that they formerly occupied the country in very considerable numbers. They were savages, subsisting almost exclusively upon fish, and the flesh of wild animals. They lived in rude huts of poles, thatched with grass, or covered with bark, and were clad in garments woven from the bast of trees, or in such as they made from the skins of salmon, seals, and the beasts of the forests. These peculiar people have been gradually amalgamated with the more civilized and warlike races which entered Japan from the south; so that none can now be found on Hondo. A few thousand, however, still exist on the island of Yezo. They call themselves Ainos, and are remarkable for their unusual hairiness, by which they are readily distinguished from the Mongolians. They seem to have made little or no progress in art or civilization during the last thirty centuries. Their agricultural skill is exhibited chiefly in digging native lily-bulbs, yams, and burdock-roots, and in gathering edible seaweed and wild fruits. Their domestic animal, if he can be so called, is a wolf-like dog, which is able to hunt and fish for himself, and is sometimes useful in dragging sledges, but, as often happens among civilized men, appears to be principally prized for the pleasure of his company.

The conquerors of the Ainos undoubtedly brought from their respective countries much knowledge of the arts of agriculture, pottery, and metallurgy; and they have steadily improved in learning and civilization. Some of their industrial arts have been brought to such perfection, notwithstanding their total ignorance of Western science, that this wonderful people have successfully competed for the highest honors at the recent World's Expositions. Their paper is thinner, smoother, and tougher than that of any other nation, and is

put to a greater number of uses. Their lacquered ware, which is made of wood, and covered with the milky sap of poisonous sumachs, variously stained, is infinite in the variety of its forms and applications, elegant in shape, beautiful in color, and exceedingly durable. The heaviest and most elaborately-wrought castings of bronze in the world were made centuries ago by Japanese artisans; and the most charming and costly bronzes, inlaid with silver and gold, lately exhibited at Philadelphia and Paris, were from the same country. Japanese porcelain has never been surpassed in the excellence of its form, color, or quality; and the perfection of Japanese swords in style and temper has rarely been equalled elsewhere. In cabinet and joiner's work, in the dyeing of silks, in weaving and embroidery, and in carving wood and ivory, the Japanese can compete creditably with any other nation.

The clothing of the masses has been chiefly of straw, cotton, and silk, and less costly than that of almost any other people living in houses. The fashions have been peculiar, but apparently unchangeable from generation to generation. A very large proportion of the lower classes have been accustomed to adorn their entire skins with elaborate pictures in blue, or blue and red; but very recently the practice has been interdicted by law. A man thus tattooed with India-ink and vermilion, though it required much patient suffering to get into such a suit, was always fashionably attired. The colors also were fast, and the material self-renewing; and, as he bathed every day, his dress was always clean.

The emperor Sujin, who died in the year 35 B.C., may be regarded as the father of Japanese civilization, agriculture, and religion. He is said to have erected the first temples for the worship of the gods, to have encouraged the building of vessels, and opened communication with Corea, to have been the first to order a census, and to establish a general system of taxation, and to have greatly enriched his country by the construction of water-courses, canals, and reservoirs for the irrigation of rice-fields. In the year of our Lord 203 the empress Jingu invaded Corea; and, as the result of this expedition, many improvements in the arts were imported and adopted. The literature of China, the philosophy of Confucius, and the worship of Buddha, all

soon reached Japan through Corea, and exerted a powerful influence upon the subsequent development of the nation. Agriculture was improved by the introduction of excellent horses in 284, and of the Chinese mulberry and silkworm in 462. Many new varieties and species of vegetables, grains, fruits, and flowers, were also doubtless imported, and new methods of cultivation made known.

Although the Japanese have possessed from time immemorial many of our domestic animals, yet they have derived but little benefit from them in consequence of the peculiar tenets of their religions, which discountenance their slaughter for any purpose whatever. Sheep were introduced by the Portuguese in the sixteenth century, but were not considered of any value by a people who would neither eat mutton nor wear woollen clothing. Swine ran wild in the forests, but were not domesticated. Europeans enjoyed comparatively free commercial intercourse with Japan for about one hundred years previous to 1650; and they doubtless brought in some valuable seeds and animals, though it does not appear that many important results accrued from these importations. The choicest animal known to have reached the empire during this period was a horse transported from the Philippine Islands by the Spaniards in 1592. The most noteworthy plant introduced from Europe was tobacco, which has become a universal favorite, and is smoked by all classes and both sexes, though in moderation.

As the chief producer of wealth, the farmer in Japan has always held a high rank, only government officers, priests, teachers, and soldiers being regarded as his superiors. Below him in the social scale were ranked mechanics and artisans, bankers and merchants, physicians, actors, and all other classes, without regard to wealth, learning, or ability. The agricultural population, according to the last census, numbers about sixteen millions, or nearly one-half the entire people, and the men are usually able to read, write, and cipher. Originally the Mikado was regarded as sole owner of all the soil, and supreme ruler of all the people of Japan. In ancient times taxation was comparatively light, but afterward became excessive, when the feudal system was in full operation, and the empire was divided into about one hundred provinces, each with its own local daimio, or ruler.

These daimios governed the farmers, and taxed them as they pleased; and at length, before their overthrow in 1871, they limited their demands only by the absolute necessities of the tax-payers. A certain portion of the products of the soil was taken by the tax-collector, the per cent varying from forty to seventy-five, according to circumstances. At the present time the land is, to a great extent, owned by individuals, and assessed at a reasonable rate, while the taxes are not allowed to exceed for all purposes two and one-half per cent of the valuation, and are payable in money. This very moderate assessment is, however, unpopular among the farmers, because it often necessitates the sale of their crops at low rates to raise the cash for their taxes. To obviate in some measure the difficulties arising from the want of a suitable market on account of the imperfect means of transportation in certain localities, officers have been authorized to purchase farm produce at equitable prices. The revenue of the imperial government is now chiefly derived from this land-tax, which amounts to about fifty millions of dollars per annum.

The mode of living among the Japanese farmers is surprisingly simple and inexpensive. Their houses are mere shells of wood, without cellars, chimneys, glass, or paint. The doors, windows, and partitions are all made to slide, and consist chiefly of light wooden sash covered with thin, translucent paper, and without hinges, locks, or permanent fastenings. Every part is so slight and loose that a foreigner wonders how such a structure stands in a high wind. The roof is the most substantial portion, and holds the house together and in its place by its weight. In the older towns and villages excellent tiles of stone-ware are used for roofing; but in the country isolated farm-buildings are often heavily thatched with straw or grass. In Yezo the roofs are often covered with split shingles, or pieces of birch-bark, which are kept in position by logs of wood or flat stones.

Charcoal is the universal fuel, and is used with extreme economy, either in small chafing-dishes, or upon a sort of open hearth in the centre of the room, consisting of a wooden frame two or three feet square, and filled with sand or ashes. The smoke and poisonous gases generated by the combustion are allowed to mingle with the air of the house,

which is shut, in cold weather, as tightly as possible. The preservation of the race under these circumstances results entirely from the wretched construction of the houses, which are as full of holes as a sieve, and therefore well ventilated. The habit of huddling around these burning coals has undoubtedly tended to the development of diseased eyes, which are very common, and caused much of that hollow-chestedness which is a national deformity. A Japanese farmhouse is just about as comfortable in all weathers as a good canvas tent, and the ordinary life of the people is a sort of gregarious camp-life. Very little privacy is possible, and the household conveniences are few and of the simplest sort. A portion of the floor is generally of bare earth; while the rest is of wood, and raised above the ground about eighteen inches. This is usually covered with thick straw-matting, upon which the inhabitants sit and sleep as circumstances and feelings dictate. They do not use chairs, but sit down upon their heels, kneeling, and resting the instep upon the floor, with the toes projecting behind. The bed, when one is wanted, consists of a thin mattress of cotton or straw, which is spread upon the floor; and the covering is a comfortable, or quilt, of cotton. The pillow is a block of wood four or five inches high, three inches wide, and from seven to nine inches long, somewhat convex on the bottom, and concave on the top. On this is laid a roll of cotton to serve as a pad for the head. In reposing, this pillow is placed just under the ear, and is said to be comfortable for those who are accustomed to it. The object of such an extraordinary invention seems to be to prevent the disarrangement of the hair, which is very elaborately dressed, especially by the women. During the day the bedding is stored in closets constructed for this purpose, and which serve also to contain any articles of spare clothing. There are usually no tables in a Japanese farmhouse; but the food is brought in on lacquered trays with legs, which raise them a few inches from the floor. The dishes from which the food is eaten are of lacquered wood of the size and shape of a deep tea-saucer, and the knives, forks, and spoons of Western civilization, are entirely replaced by the much cheaper chop-sticks of cedar-wood. It is the business of the cook to cut up and prepare food so that it can be picked to pieces, and poked into the mouth with the

sticks, assisted by timely inhalation of the breath. The cooking is done chiefly by boiling or steaming in covered kettles of iron or copper. Baking and roasting are not common operations in Japanese cooking, as bread and meat are rarely eaten. The universal substitute for bread is steamed rice, which is eaten without salt, sugar, milk, butter, or oil. It constitutes by far the greater part of the daily food of the agricultural population, and is both easy of digestion and very nutritious. But every Japanese demands with his rice at every meal a liberal supply of a stinking salt pickle made of radishes. Beans and pease also constitute an essential part of the food of vegetarians, and these are eaten in a great variety of sorts and in numerous ways. Soy, the common sauce for fish and vegetables, is produced by the fermentation of beans and wheat, with the addition of salt and vinegar. The Japanese eat every thing edible which grows in the water, and are very fond of raw fish, and also of seaweed, which is cooked in many ways. As they do not use milk, they make cheese from the flour of beans and pease; and, as a substitute for butter and lard, they eat the oil obtained from the seed of a sort of cabbage, which is largely cultivated for this purpose. Nearly every vegetable, grain, and fruit, cultivated in this country, is raised in Japan; and several species are highly esteemed there which we discard, such as burdock-roots, lily-bulbs, and the leaf-stalks of a species of *nardosmia*. Perhaps the most extraordinary thing in regard to the food of the Japanese is their preference of green fruit to that which is ripe. Peaches are considered edible as soon as the stone is too hard to break with the teeth; but before this they are considered unhealthy. Plums, apricots, peaches, and melons are preferred in an unripe state. Apples and pears are also consumed when very hard, and indigestible for any one but a rice-eater. Oranges and lemons are very abundant and excellent. One variety of orange is very delicious in flavor, quite free from seeds, and with a skin so thin that it is readily removed with the thumb-nail. You can buy twenty for a cent, and eat them at one sitting. Grapes are scarce; but kaki, a large persimmon, is a common and favorite fruit, especially in the South.

The universal beverage of Japan is tea, which is drunk

from small cups in the form of a strong decoction, without milk or sugar. As a matter of politeness, tea, with cake or candy, is offered to every visitor at the house or office or store at all hours of the day or night. The tea of the farmer consists of stems and coarse leaves, the refuse of the choicer sorts, and is sold for a few cents per pound; while that of the wealthy — consisting of tender leaves carefully rolled and culled by hand, and, for the finest brands, raised in the shade — costs as many dollars per pound. The Japanese have neither grape nor palm wine, and therefore manufacture an alcoholic beverage from rice by fermentation and distillation. This is called saké, and is consumed in considerable quantities, notwithstanding the recently propounded doctrine that vegetarians have but little desire for alcoholic stimulants. Although it often happens that those who indulge in saké drink too much, and become more or less intoxicated, yet it is rare that any public demonstration is made by them. This is due partly to the comparative mildness of the liquor as drank, and partly to the good temper and obedient and respectful spirit of the people. The promptness and certainty with which all violations of law are punished also act as a powerful restraint upon those who are inclined to do evil.

The habit of smoking opium is hardly known, and strictly forbidden, among the Japanese. Tobacco, however, they seem to enjoy far more than any other people; because, though they smoke very frequently during the day, they are very temperate in regard to the amount consumed, and therefore suffer little from excess. They use an exceedingly mild, fine-cut tobacco, which they burn in a very small metallic pipe, the bowl of which is inversely conical in form, and never exceeds half an inch either in diameter or depth. One pipeful furnishes precisely three whiffs of smoke, which is often ejected through the nose. Three pipefuls of tobacco, or three times three whiffs, are essential to a regular smoke; and for this restful pleasure farm-laborers, both male and female, stop work at a given signal for fifteen minutes once in the middle of every forenoon, and usually twice every afternoon. Everybody likes also to enjoy a refreshing nap after dinner; and both men and women may be seen at this time stretched out on the ground in the fields, or on the floors of their open

houses, in sweet unconsciousness. The hours of actual labor vary from eight to nine, beginning usually very early in the morning. The wages for capable workmen on the farm vary from twelve to twenty cents per day without board, and women usually receive one-half as much as men.

The agricultural population of Dai Nippon wear very little clothing, and that of the cheapest sort. For a dress-suit, the farmer has a short, loose blouse and tight pants of blue cotton ornamented with certain marks or figures in white. For a stylish head-dress, he wears a blue cotton handkerchief or towel, tied on variously according to the weather. He prefers, however, to appear without any covering to his shining pate and comical top-knot, which, in absurdity, eclipses the Chinaman's pig-tail. The old-style Japanese shaves the hair from his temples and from the top of his head, and then binds the long hair tightly into a cue behind. This is heavily waxed, and tied into a roll, without braiding, and then brought up over the crown of the head, and laid carefully on the bald place in front, the end being cut square. This unique style is said to have been originally a military device to keep the hair out of the eyes, as it certainly does. When at work in the fields, both sexes prefer to reduce their clothing to its lowest terms, and are evidently not afraid of getting sun-burnt; but in very hot weather they often wear a flat straw hat two or three feet in diameter, which is sometimes attached to the head by a frame-work and strings, so as to allow of the freest ventilation. In rainy weather they wear a thick garment of woven grass, which sheds water precisely like a thatched roof. They wear also waterproof hats and coats of heavy oiled paper, from which material their umbrellas both for sun and rain are also manufactured. In the warm, wet rice-fields, laborers naturally go barefoot; but on the roads and mountains, especially in winter, they require some protection for the feet. As leather is a rare article in a country where animals are not slain for food, the Japanese have ingeniously woven and braided sandals, shoes, boots, and leggings, out of rice-straw and the leaves of the cat-tail flag. They also wear moccasons of deer-skin with the hair on, and in wet weather they use clogs of wood. Even their horses and cattle, when employed on hard roads, are shod with shoes which answer an

excellent purpose for a single day, though made simply of rice-straw.

Japanese shoe-blacking and Japanese soap are extensively advertised for sale in this country; but the Japanese language contains no name for either: both are unknown quantities in old Japan. Liebig once said that the amount of soap used by any people might be taken as an index of their civilization; but he knew nothing of Japan. How could a people without soap-grease invent soap? The universal detergent in Dai Nippon is hot water; and, if this will not start the dirt, and sand cannot be applied to aid it, the virtues of alkali from wood-ashes are well known and employed in a practical way. The Japanese are scrupulously clean in their persons and dwellings. They have a saying, that, when the houses of a nation are kept clean, you may be certain that the government is respected, and will endure. According to their history, their government is the most permanent in the world, having continued under one and the same dynasty for 2538 years; the present emperor Mutsuhito being the hundred and twenty-third ruler descended in a direct line from Jimmu Tenno, the first mikado. Cleanliness with them, as with us, is akin to godliness. There cannot be found in any other country so frequently and thoroughly washed a people as the Japanese. Every man, woman, and child is expected to be soaked in hot water every day so long as life lasts. They are, however, in this business of bathing as in every thing else, very economical, and compel a small quantity of water to cleanse many skins. In the cities and villages public baths exist, where hundreds of persons of all ranks, ages, and conditions, and of both sexes, plunge into the same tank, until the hot water reminds a Yankee observer of the water in a wash-tub in which a week's washing for a large family has been done. They adopt, however, the same method for obviating the objection to this course that is used by the washer-women; namely, to rinse the washed articles in clean water, which is furnished in a small tub to each person on emerging from the common tank.

Though the Japanese have bred neat-cattle in small numbers from the earliest times, they have not been accustomed to milk their cows, nor to eat beef, veal, butter, or cheese. Those persons who killed and skinned animals, and made

leather, were considered such miserable outcasts, that they were forbidden to eat or sit with other persons, or to enter their houses. They were not enumerated in the census, and enjoyed no legal rights; while the land on which their villages stood was never measured, nor mentioned in documents relating to the public roads. What must have been the astonishment of the great embassy from Japan in 1872, to learn that the President of the United States had once been a tanner! Cattle were formerly raised chiefly for transporting heavy materials either upon pack-saddles or upon carts; and for this purpose a cow was worth from twenty to thirty dollars, and a large bull weighing from twelve hundred to sixteen hundred pounds would sell for from thirty to fifty dollars, according to locality. Such animals are also sometimes employed, by farmers who can afford it, in ploughing the wet soil of the larger rice-fields. The plough is very primitive in its form, and has an iron point about eight inches long by six inches wide in its broadest part, and resembles the shovel or bull-nosed plough of our Southern States. Drawn by a solitary bullock, and skilfully managed by its single handle, such an implement turns a very good furrow in soft mud, and covers sufficiently well the green crop which is buried as a fertilizer. Japanese cattle are peculiar in form, resembling somewhat the American bison. The back is thin and relatively high just behind the shoulders, and the hind-quarters are rather light. The horns are of moderate size, and in some cows quite small and delicate. The tail and bones are fine, and the legs often rather long; while the udder is very small. The prevailing color is a dark ash-color with black head and points, though in the north of Hondo there are many animals marked with white, and occasionally one of a yellowish-red, and very rarely a brindle. In the south the size and color are more uniform, and the resemblance to the buffalo quite striking. The grade animals resulting from the cross of the native cows with Short-horn and Devon bulls are generally handsome, and show decided improvement in form, weight, and rapidity of growth, though valuable milking qualities have not yet been developed. The milk of the native cows is very rich in butter, and resembles that of the Jerseys; but the quantity is small.

The Japanese horse has many of the qualities of the mustang of California, and is capable of doing good service in almost any kind of work. Black, chestnut, and bay are the predominating colors. The southern horses are of fair size and substantial form, and are employed for riding, or under the pack-saddle, but not often for draught. In the streets of the cities may be seen many fine-looking stallions, led by men who evidently do not intend to allow their horses to get the advantage of them. They carry loads of three or four hundred pounds' weight, and seem generally well fed and full of life. Their propensity to fight with one another is restrained very effectively by a thick iron ring which is slipped on to the lower jaw, and fastened to the saddle-girth by a short, stout rope. The muzzle of the horse is thus drawn down within three feet of the ground, so as to render it quite impossible for him to bite, rear, or strike with his forefeet.

This fashion of checking a horse's head *down*, instead of *up*, is only one of many ways in which the Japanese reverse our methods. They back their horses into their stalls so that they cannot kick, and can be conveniently fed. They approach and lead them on what we call the "off" side, and they mount and dismount on the same side. Instead of admiring a long, flowing tail, those who can afford it tie up this ornamental appendage in an elegant silk bag; and a stylish rider, despising an arching neck, tries to make his spirited steed stick his muzzle straight out, so that his nose shall be high in the air and on a level with his ears. To accomplish this, he stretches his arms as far forward as possible, and seizes his reins about six inches from the bit. Finally Japanese horses, in a land abounding in excellent iron and skilful blacksmiths, are shod with shoes of straw, and are often fed on cooked food. Blacksmiths sit while at work, the anvil and fire being on the ground, and blow the bellows with their toes. Carpenters and tailors hold their work with the same members, and the former draw the saw and the plane towards them in cutting, instead of shoving them away. They fasten pieces of wood together with pegs of bamboo, instead of nails, cut square holes with chisels for pins in joining timber, instead of boring round ones with augurs, and depend largely upon dowelling and dovetailing

for strength. In writing, the Japanese begin at what we call the last page of a book, though not at the bottom of it, but at the top; yet not at the left-hand corner, but at the right-hand one: nevertheless, they do not proceed from right to left, but from top to bottom, so that all the lines are vertical; and, in reading, they begin at the top of the last column, and, having finished that, begin again at the top of the one next to it on the left, and so on to the place called by us the beginning. The title of a book is always printed on the front edges of the leaves, instead of on the back of the cover, and every leaf is double instead of single, and so the paper is printed only on one side. Candles in Dai Nippon do not fit into a socket of the candlestick, but are made hollow so as to slip on to it. Japanese do not kiss, nor rub noses, nor shake hands, nor rise up, in saluting, but show their respect for each other by repeated bowing, rubbing their own shins with open hands, or by touching the forehead to the floor or the ground.

In the island of Yezo are several herds of wild horses which belong to the government, and which are never fed, though the snow often lies on the ground for weeks at a time, and all vegetation ceases during the long cold winter. The principal fodder of these animals at this season is a small, hardy bamboo, which covers immense areas of the country, especially on the mountains, attaining a height of six or eight feet. The foliage remains green under the snow; and the horses dig for it with their feet, or liberate the elastic stalks by trampling among them. The only assistance rendered them by the keepers of the herds is to protect them from the attacks of bears and wolves, and, in the case of deep snows, to drive them to localities where the bamboo is abundant. While most of the horses thus reared are somewhat stunted in growth, and defective in form and spirit, there are some admirable specimens which are fleet, sure-footed, and lively. They are sold in the wild state at the very moderate price of six dollars and a half apiece; and the best of them, when broken, would readily sell in Massachusetts at one hundred dollars each.

The Japanese are very fond of riding and driving; and the number of horses will undoubtedly increase rapidly, now that all classes are allowed the privilege of using them, and a

proper system has been adopted for the construction of roads in all parts of the empire. At the present time, however, nearly all the vehicles for pleasure or business travel are literal "pull-man cars," being drawn by one, two, or three men. They are built in the form of a light, two-wheeled chaise on elliptic steel springs, and cost about fifteen dollars apiece. There are tens of thousands of them licensed as cabs and hacks in all the larger towns and cities; and most of the native as well as foreign gentlemen who can afford to keep a team use men instead of horses. There are many advantages appertaining to this mode of travel, as the human horse drives himself and finds the road, does errands and imparts information, and, at the end of the journey, feeds and takes care of himself and the vehicle. Two men will draw a traveller, with fifty pounds of baggage, fifty miles in ten hours, and on some routes will gladly do it for one cent per mile, and find themselves. Where the roads are bad, travellers must ride on horseback, or they can be carried in a handsome box suspended on a pole, borne on the shoulders of two or more men. The emperor was formerly carried in a splendid structure like a small house, on the shoulders of fifty bearers; but now he rides in a superb English coach drawn by four American horses.

In regard to other domestic animals there is little of importance to be related. Ducks and fowls are numerous and in considerable variety. The white Pekin ducks are very large and prolific; and the mandarin is extremely beautiful both in form and color, resembling somewhat our wood-duck. Of fowls, there are very small bantams, elegant games, and heavy breeds of various colors. The plumage as a rule is much finer than that of our fowls, the hackles and tail-feathers being of extraordinary length and brilliancy.

In practical agriculture the Japanese are remarkably skilful, and have numerous methods and customs which might well be imitated by us. There cannot be found in any other country extensive fields which produce more human food to the acre, or which are more free from weeds, or which maintain their fertility from generation to generation more perfectly, or which more completely charm the eye of an intelligent traveller. The most important characteristics which distinguish Japanese farming are the following; viz., first,

irrigation; second, fertilization by liquid manures repeatedly applied to the growing crop; third, cleanliness of culture; fourth, thoroughness of tillage; fifth, constant cropping of lands without deterioration; sixth, extreme simplicity and economy of method, involving the minimum of expense for seed, manure, and tools; seventh, the extraordinary scarcity of domestic animals and teams with agricultural machinery.

For more than twenty centuries the construction of expensive works for the irrigation of rice-lands has been going on in Dai Nippon; and their aggregate value at the present time is enormous, more than ten millions of acres being furnished with abundance of water as required. To accomplish this invaluable result, mountains have been tunnelled, immense reservoirs constructed, thousands of miles of canals and millions of miles of smaller water-courses dug, and the whole vast territory terraced, levelled, and enclosed. Beginning at the heads of the valleys in the mountains, the land is divided into small, irregular plats, each containing an area of from a few rods to several acres, and surrounded by a low embankment of earth about a foot wide, and somewhat more in height. The size and form of these plats depend upon the natural surface and the amount of labor available for the work of levelling. Into each one water flows from a distributing ditch, and then moves slowly on to another plat at a slightly lower level. Finally, near the level of the sea, immense fields are often found which require comparatively little labor for preparation, but which are often too wet for any other crop than rice. Sometimes on these lowlands it is necessary to raise water from the ditches on to the young rice by artificial means, and for this purpose a portable tread-mill is used, of very simple construction, but which lifts water rapidly for two or three feet. The water is also sometimes raised by means of an ordinary well-sweep and bucket.

While the Japanese understand the value of ashes, plaster, lime, fish-pomace, seaweed, grass, and other green crops, in the fertilization of land, and use them freely when attainable, still they rely chiefly upon night-soil. This is carefully saved and collected, and usually kept in a fermented state, in a liquid form, in large tubs or tanks, which are either sunk in the earth, or kept above ground in some convenient spot. This is distributed frequently over the cultivated fields by

means of large covered buckets suspended to a neck-yoke. These buckets are furnished with a suitable orifice in the bottom, through which the fluid is allowed to escape in a small stream upon the drills or rows, in which all crops are planted except rice. Upon this, liquid manure is applied by mixing it with the irrigating water which covers the fields to the depth of a few inches. The cost of thus annually enriching land, so as to get a good crop, and maintain its fertility without deterioration, is about twelve dollars per acre. This application of plant-food in solution renders it immediately available to the roots without regard to the rainfall, and, in connection with irrigation, insures a remunerative crop. A real famine is a most uncommon calamity in Japan.

Weeds are almost unknown on the arable lands of Japan, and there are large tracts where not a single wild plant can be found. Every individual stalk of valuable vegetation receives attention from the farmer, and every useless plant is eradicated before it blossoms. The seeds which in this country are so commonly scattered over our fields in the manure from our pig-pens and barnyards are not thus disseminated in Dai Nippon.

The implements of tillage are the spade and the mattock, and they are used with remarkable fidelity and skill. The soil is constantly stirred to a considerable depth, and for many crops is raised into narrow ridges from six inches to three feet in width, which are often a foot high and about the same distance apart. Thus the whole top-soil is placed at the disposal of the roots, which readily penetrate it, and it is much better aerated than when spread over the entire surface. The subsoil is frequently heavy and wet, and from this the moisture rises to the roots in the mellow ridges, and vegetation goes on with great uniformity and vigor. After the harvest of the winter crops, the ridges are all levelled, and the ground prepared for the flat cultivation of the rice-field, which is then flooded with water during a portion of the summer.

The market-gardeners around Paris are said to have habitually, at least two crops growing on their land at the same time, and not infrequently to harvest eight crops of vegetables of various sorts in one year. The best farm-lands of Japan produce a winter crop of some cereal, as wheat, bar-

ley, or millet; or of colza or rape-seed for oil; or of radish, turnip, or cabbage, or some other vegetable. The same land, when well irrigated, yields in summer an abundant return of rice, the most important food-plant of the country. Upon fertile fields not well supplied with water, the summer crops may be beans or pease, yams, melons, sweet-potatoes, squashes, maize, sorghum, cotton, or almost any other desirable plant. Of perennial crops, the most valuable are sugar-cane, tea, Chinese mulberry, and paper mulberry. In this favored land seed-time and harvest occur together almost every month in the year, and the farmer can never complete his work.

Almost all the operations of agriculture are performed by hand, and the tools employed are simple and cheap. Wheat is sowed by hand in drills, is hoed with a mattock, is cut with a grass-hook, threshed on the ground with a flail, winnowed with large fans, or tossed in a basket, put up in straw bags, and usually ground by hand. The total value of all the tools and appliances used in raising a crop of wheat, and preparing it for market, is less than ten dollars, and little else is required for any or all other crops. As there are very few domestic animals, there is no need of fences, and so this enormous expense is spared. The farm-buildings are also very small and cheap, as there is no occasion for barns, and the farmers are not proud. Small, one-storied, unpainted houses, with paper windows, and a hole in the roof for ventilation, satisfy the desires of the most ambitious among them. They prefer to dwell in villages, but are very fond of ornamental hedges, evergreen shrubs, shade and fruit trees, and beautiful flowers, around their habitations. These inexpensive but showy surroundings greatly relieve the cheapness of their dress, and the scantiness of their furniture, and give a general impression of cheerfulness. Time would fail us even to enumerate all the interesting forms of vegetation with which this charming country is adorned. But he who has seen the bright green stems and feathery foliage of a bamboo-grove rising to the height of from fifty to a hundred feet, and has learned the manifold uses of this arborescent grass, and its wondrous habit of growth, will always rejoice at the recollection of it. The Japanese are very fond of fine scenery, and often undertake excursions to such localities as afford good views of it. They are also accustomed to

build temples and shrines upon elevated sites in the vicinity of towns and cities, and to visit them frequently for worship and pleasure. These high places are usually approached by well-constructed roads and walks, and massive stairways of cut stone, and surrounded by magnificent groves of gigantic evergreen trees, which have been carefully protected for centuries. Camellias, azaleas, double-flowering apples and cherries, and other ornamental trees, shrubs, and herbaceous plants, in great variety, are also freely used for adornment. The people appreciate and enjoy these things of beauty, and cheerfully contribute to the maintenance of the priests who care for them; and, as a matter of course, they never steal nor injure them.

In propagating plants, both from seed and by extension, the Japanese are exceedingly skilful; and they also cultivate and transplant trees with great success. They are very fond of oddities which it requires great time and care to produce; such as old, dwarf trees grown in minute pots, small trees standing on three or four long slender roots resembling spider-legs, and trees trained into the form of miniature houses, boats, or animals. They delight in coaxing a single branch of a pine to extend itself a long distance from the trunk in a horizontal direction, so as to look as artificial as possible. It is also common to bring all the main branches of a pine into a horizontal position, either on the ground, or at about six feet from it, and carefully bind them to poles of bamboo; by which treatment the tree, after many years, comes to resemble a gigantic toadstool. On the shore of Lake Biwa stands a red pine which can be hardly less than three hundred years old; and the immense branches are supported on posts, and extend so as to cover a circular area some three hundred feet in diameter, while the height of the centre may not exceed fifty feet.

In the cultivation of rice, the seed is sown thickly in well-prepared beds under water, and when about six inches high, in early summer, it is transplanted by hand, in small clumps eight inches apart, into the muddy fields. At this season men and women may be seen wading up to their knees in the flooded plats which have been carefully manured with some green crop turned under by means of plough or spade, or with grass and herbage gathered for the purpose in the

forests or on the mountains. When the mud is very soft and deep, the grass is sufficiently covered by merely trampling it down with the feet. The after-cultivation consists in pulling up all weeds and grasses by hand, in pouring on liquid manure, or applying some solid fertilizer, and in properly regulating the supply of water. Rice yields from twenty to sixty bushels per acre, and is worth, when cleaned thoroughly, about one dollar per bushel. The total annual product of the country is a hundred and fifty millions of bushels.

The second most important agricultural industry of Japan is the production of tea, which is gathered either from wild or cultivated shrubs. The plantations are set in rows about six feet apart, and last for many years, according to soil, climate, and treatment. Tea may be grown upon almost any soil; but the best comes from the vicinity of Uji in the southern part of Hondo. The soil of this region is a light-colored, gravelly loam, which yields but small crops of cereals. In the most valuable fields the shrubs are from a hundred to a hundred and fifty years old, and the stems very numerous, the largest being from one inch to three inches in diameter. The clumps or rows are about three feet thick and four feet high, and are carefully pruned every season. The ground is kept quite clean, and enriched with liquid manure. During the spring and early summer the fields are entirely covered over with mats of rice-straw spread upon bamboo-poles at a height of six feet above the earth. This gives the country a very extraordinary appearance by no means attractive. The object in thus shading the shrubs is to partially blanch the foliage, and check the development of the chlorophyl so as to render the leaves more tender and delicate in flavor. The crop is thus diminished in quantity, but enhanced in quality and price. About the middle of May, when the young shoots are three or four inches long, the women and children begin the first picking, which furnishes the best tea. The picker seizes the shoot just below the middle, and with a quick jerk strips off two or three leaves and the soft tip, and drops them into a basket. The fresh leaves are carried to the curing-house, where they are steamed in a close vessel for an hour. They are next put into paper trays over a small charcoal-fire, and rapidly dried.

This is the critical point in the process, when the leaves must be constantly stirred, and rolled between the hands of a skilful workman. When perfectly dry, the tea is picked over with care, and only the handsomely rolled leaves selected for the first quality. The remainder, consisting of the coarser leaves and hard pieces of shoots, is sold at a lower price. The second picking occurs as soon as the new growth has attained sufficient size, and the leaves are treated in the same manner. The mats are now removed from the poles, and the full power of the sun allowed to act upon the shrubs to give them as much vigor as possible for the growth of the ensuing spring. At the end of summer a third picking is made, which is converted into ordinary tea. The produce of an acre of the best old shrubs is valued at $3,030.30. The total crop from three pickings is estimated at 666 pounds, of which one-half is first quality, worth $8.80 per pound, and the rest is worth thirty cents a pound. Good tea land in Uji is worth three hundred dollars per acre, and the best fields of old plantations are prized at four thousand dollars per acre. The women earn about six cents per day in picking tea, and the men in the curing-houses receive from twenty to fifty cents according to their skill. The tea is packed for market in close boxes or jars, which are tightly covered with waterproof paper. Of course the best tea can only be enjoyed by very wealthy people, and is never sold for exportation. The ordinary tea-crop is worth from seven to forty cents per pound, and immense quantities are produced. The annual export is nearly twenty-five million pounds, and is consumed chiefly in the United States. Japanese tea is all green tea, but is not sent to this country as received from the producers. The different lots are mixed to suit foreign tastes, and "fired" again; that is, roasted again at a low temperature in metallic trays, and then packed in tea-chests for shipment. Every effort is made to get the new tea into market while its aroma is fresh and sweet, and ship-loads are now sent from Yokohama to New York in less than thirty days.

Did time permit, we might, in a similar way, discuss the production of silk from both the wild and the Chinese mulberry, of lacquer and of wax from two species of poisonous sumach cultivated extensively for these articles, of paper

from the paper mulberry, of sugar from sorghum and from the sugar-cane, of cotton from the cotton-plant, of oil from cabbage and other seeds and nuts, and of charcoal and lumber from plantations of forest-trees. But enough has been stated to demonstrate that the art of agriculture has been long since brought to remarkable perfection by a people who had no knowledge whatever of the sciences to which we are accustomed to ascribe so much of our progress, and who never enjoyed the benefits even of a board of agriculture.

When, in 1872, the great embassy from Japan visited this country and Europe, they were amazed at the enormous quantity and immense value of the agricultural products of the Western nations. They perceived that by the introduction of live-stock, improved machinery, and scientific methods, the annual income of their own land might be increased many fold, and the balance of trade with foreigners be perpetually maintained in their favor. When they inspected the Massachusetts Agricultural College, and were made acquainted with its plan and purposes, and saw the students at work in the laboratory and the field, and then at drill with their rifles and cannon on the parade, they exclaimed at once, "This is the institution for Japan, for this will teach our people both to feed and to defend themselves." From that time extraordinary efforts have been made to improve their agriculture. Gen. Horace Capron, the Commissioner of Agriculture at Washington, was at once invited to accept a similar position in Japan, and furnished with a very large sum of money for the purchase of the best implements, machines, and live-stock of all sorts, as well as seeds and fruit-trees of the choicest varieties. Model and experimental farms were established in different parts of the empire, and placed under the direction of Japanese officers educated at the Massachusetts college. But the government soon learned that a large number of well-trained and thoroughly intelligent men were indispensable to success in the speedy improvement of their agriculture. Accordingly the Sapporo Agricultural College was established in 1876, and liberally furnished with every thing requisite to its highest usefulness. About forty-five thousand dollars is annually expended upon it, of which sum fifteen thousand dollars is devoted to the expenses of the farm. As the number of students is limited to fifty, and as

money is worth at least five times more there than in Massachusetts, while the farm is already admirably equipped in every particular, we need not be surprised that the results are entirely satisfactory to all parties. The president and three of the professors of this college are graduates of the institution which owes its foundation and much of its prosperity to the Massachusetts Board of Agriculture, and we may properly congratulate ourselves, that, however little we may be appreciated at home, our honest and zealous efforts for the advancement of scientific agriculture are receiving a most gratifying acknowledgment, and producing abundant and most precious fruits, in the romantic land of Dai Nippon.

Adjourned to Wednesday at ten o'clock.

SECOND DAY.

The Board met at ten o'clock, Capt. John B. Moore of Concord in the chair.

The Chairman. Let me say, before I introduce Mr. Paul to you, that he is a working, practical farmer. What he tells you, you can rely upon: there is no nonsense about it. Now, gentlemen, allow me to introduce to you Mr. Paul of Dighton.

MY FARMING EXPERIENCE.

BY ALFRED W. PAUL.

Until within a few years, bright and promising boys in the family were educated for the professions and other occupations, while the dull and unintelligent were deemed entirely competent to perform the varied duties of husbandry; but that view has passed away, and ignorance is not now considered a recommendation, nor stupidity a guaranty of success, in farming any more than in other kinds of business. At the present time the most intelligent and skilful even do not attempt to master the whole of agriculture, but devote their energies to a few of its branches.

To the practical farmer, problems are being constantly presented, and upon their solution depends his success or

failure. For what crops are his various soils best suited? How deep, and at what seasons of the year, and how many times, shall he plough and harrow his land to obtain the best results? What kinds of manures and fertilizers shall he use? and where purchase them? Just how deep in the earth shall he place the various seeds, when scarcely any two kinds require the same depth of covering? and at just what season — early, medium, or late — shall they be planted? What farming tools and implements, and how many, can he obtain and use prudently and profitably? How much cultivating and hoeing shall he give his crops? How shall he guard against floods and drought, and frosts and extreme heat? how protect his fields from rust and blight and mildew? How can he destroy the numberless insects that prey upon every product of his farm? What kinds of horses, neat-cattle, sheep, swine, and poultry, shall he keep? and how, and upon what kinds of food, can they be most profitably reared and kept? When his various products are ready for market, when and where shall he sell them? Shall he immediately dispose of them, or shall he keep some of the least perishable for higher prices? and, equally important, when and where shall he make his many purchases?

It may be safely said, that to correctly solve these and the hundred other practical questions that are presented in the experience of every thinking farmer will require the sharpest intellect, a wide range of reading, and the broadest and closest observation.

Undoubtedly agriculture holds out greater inducements to the industrious young man of good habits than any other calling. And yet there is no easy, lazy road to success in this any more than in other occupations. Persevering industry and self-denying economy are the *only* conditions of success; and, these granted, a competence is assured. A proper and wise economy requires liberal outlays prudently expended.

But I am invited simply to relate my farming experience. I would say at the outset that it has been neither exciting nor particularly interesting; and, as the time will not permit of giving details, I shall briefly discuss some of the principles upon which my farming operations have been conducted, and then give you the results financially.

I purchased my farm in 1847 for two thousand dollars. The land had been rented, or let on shares, the most of the time for the preceding twenty-five years, and was badly impoverished. It consisted of about twenty-eight acres, — fourteen acres of tillage and pasture-land (the pasture-land was susceptible of cultivation): the rest was waste land, of which I have since reclaimed two acres. Thus I have in cultivation about sixteen acres.

The poverty of the soil at the time of purchase was not its only or even its greatest defect. It was divided into eleven fields and enclosures by stone walls. I have since materially reduced the number by the removal of a portion of the walls. Every field contained within its limits at least one low, wet place (and some of them two and even three), which, after great rains, was always flooded. Other parts of the same fields were pinched by even a moderate drought, the subsoil being a loose gravel. Very wet springs, portions of every field could not be ploughed before June.

I bought such a farm for two reasons: one was, I had no money to pay for a place, and I could get this on credit; and the other was, I knew no better.

I then had a deed of a farm, but owed every dollar it cost, and possessed neither a farming tool nor an animal; neither had I money to pay for either.

I commenced, as you may well believe, in a very small way. I exchanged my labor with my neighbors for team-work both to do my ploughing and other farm-work, and also to cart my hay and other produce to market. I taught a country school in winter, thus turning to account the whole year; that is, years ago, when I first commenced.

I soon discovered, what every farmer quickly finds out, that manure is needed.

Such a thing as buying it never entered the thought of any man in the community in which I was located. As I had no money to purchase with, I studied how to get it. I finally concluded to raise pork. From all I could learn by reading and inquiry, I became satisfied, that in an average of years, with an average of hogs, the pork would pay for the grain consumed, and I should have the manure for my labor and trouble.

I accordingly tried it, some years making as much as five

thousand or six thousand pounds. Some of my neighbors asked me repeatedly, in a manner not reflecting credit upon my judgment and management, whether it paid to keep so many hogs. But they have not criticised me unfavorably now for several years: I mean as a farmer.

My pork has just about paid for the food consumed. Some years there was a profit: one year I sold three hogs for twenty cents per pound, when they actually cost about ten cents, clearing some ninety-five dollars.

I have found that one bushel of corn or meal will make about ten pounds of pork, and knowing the price of corn enables me to determine for what price I can make and sell the pork without loss. Thus, when corn is sixty cents per bushel, I can sell hogs, net, for six cents per pound.

Another fact I have found out in this connection, to my own satisfaction at least, that for profit hogs should be killed rather young, say, from eight to twelve months of age.

I kill twice a year; but then I force my hogs with all I can get them to eat, and with a variety of food at that.

But the quantity of manure I made was wholly inadequate to my wants. As soon as I could spare money, I bought fertilizers, — wood-ashes (which I could then buy, even of farmers, at from twelve to seventeen cents per bushel) and Peruvian guano.

I have continued, until the present time, to buy and use various substances; such as leached and unleached ashes, Peruvian guano, bone-meal, dissolved bone, super-phosphate, Brighton fertilizer, fish-pomace, slaughter-house and stable manure, and, I may add, Stockbridge fertilizer. The present year I have used no ashes, but, for the previous twelve years, from five hundred bushels to nine hundred bushels per year. Leached ashes give as good results on my land as unleached. Thus far, I have used nothing that has paid as well as ashes and Chincha-island guano; while Brighton fertilizer and slaughter-house manure have paid the least. I am sorry to say that the Stockbridge fertilizers don't seem to help my crops as I hoped.

I have purchased, and used on my sixteen acres of land, for the last nine years, an average of more than seven hundred dollars' worth yearly of such fertilizing substances as I have already mentioned: in addition, my cattle, hogs, and

poultry have made yearly at least two hundred dollars' worth more.

This, on market-gardens near cities, would be considered moderate manuring; but I am situated more than forty miles from my principal market, and that makes quite a difference.

I will here mention one fact that shows my faith in farming. Some five years ago, after all my bills for that year were paid, I found at its close but three hundred dollars left. Instead of investing it as in other years, I used it in purchasing additional quantities of manure, making, for the following year, an amount paid out for that purpose of a thousand dollars instead of the usual seven hundred.

I will add, that, for two or three years, I have been purchasing stable-manure of Mr. W. H. Dole of Boston, and taking it in cars to my place. As long as he continues to send me that which is of good quality, I consider it the cheapest plant-food I can buy; that is to say, for my own land and for my own crops: I cannot, of course, speak for others. I have used nearly sixty cords the fall just past, and have contracted for fifty cords more for the coming year. I shall probably use but little else at present, except some special fertilizer for certain crops, and something to stimulate an early growth in others.

The cost of carting manure and fertilizers from the railroad station and elsewhere, and applying the same, is in all cases additional to the amounts above stated.

I should say (and I am induced to say it from the discussion yesterday afternoon) that I apply my manure as some others do, and not as still others do. I put on the larger portion of the purchases in the fall of the year. I like to harrow it into my soil, or plough it in very shallow. In ploughing it, I want to hold the plough-handles myself. If the ground is hard, I am very careful to have a sharp-pointed plough, because I can plough much shallower with a sharp-pointed plough than I can with a dull point. Every farmer knows that he must plough deep with a dull-pointed plough, or not at all. I wish just barely to cover the manure. In some cases, if the ground be level, or nearly smooth, I can manage to plough not more than two inches and a half or three inches deep, just to cover the manure from the wash

and from the winds. The special fertilizers I do not apply in the fall, but in the season of growth of the crop. This is no pet theory of my own; I simply practise it, and am very well satisfied with the results; but I am ready, when I can see a better way, to adopt it in that as in every other practice in my small farming.

I may remark that in all cases my work is mapped out, at least in my head, each year for that succeeding. The amount of manure, and the kind of crop for each field, in a word, every thing, is planned in advance.

I have endeavored from the beginning to raise such crops as would be salable in the markets to which I had access, but have found in several instances that my soils were not fitted for their production. Loss resulted. I study carefully to learn for what products my land is adapted, and consider the knowledge I have gained in this matter of much value.

My rule has been, with exceptions of course, to sell my crops when they were fit for market. To do so, to take the produce from the field to the place of sale, saves the expense of extra handling, saves room for storage, and saves the loss of rot and shrinkage incident to the keeping of most kinds of farm-produce. This cannot be done always; but, so far as I can, I practise it.

I believe in thorough tillage, and have endeavored to reduce my belief to practice. I plough my land with care, although I am not an advocate of deep ploughing, and then harrow and drag until it is well pulverized, before putting in the seed.

For instance, I have the past autumn ploughed a field four times, harrowed it four times, and intend in the spring to plough, harrow, and drag it before planting. There was some discussion yesterday in regard to ploughing sward-land. This field I ploughed about the middle of August, and I question whether many of the practical farmers present, if they should go to that field now, could really tell whether there was sward there this season or not. It is almost entirely pulverized. It has been ploughed over the number of times stated; and the soil, I may say, is completely pulverized. After planting, I cultivate and hoe, weeds or no weeds, but enough to keep down the weeds at any rate. Still I must admit that sometimes, in the hurried season, weeds do

get the start; but it is only for a short time. My land is not rich enough to grow a crop of weeds in addition to what I cultivate for market.

Although, as I have already stated, I commenced in debt for every thing, yet I have always avoided making debts at the grocer's, butcher's, or with any other dealer.

I preferred to owe on notes, and pay interest even, rather than to run up bills, which, at the end of the year, might astonish me at their magnitude.

My rule has been, from which I have rarely if ever deviated, to buy for cash, and usually in such quantities as to get at wholesale prices.

I have for a good many years deposited the proceeds of my sales in a bank, to an amount sufficient to pay my yearly bills, to be checked out as wanted. I am satisfied that thus it has paid me a larger per cent than in any possible investment.

I have previously mentioned the mud-holes and wet parts of my different fields. The trouble and loss resulting from the same were serious. Some seasons, it was absolutely necessary to leave the whole field intended for hoed crops to so late a date before planting, that the crop would not mature, or else leave a part of the land, and plough and plant the remainder. The latter I have done repeatedly. Some springs dry enough to plant have been followed by great rains later in the season, and the promised harvest partially or wholly destroyed.

To remedy this I experimented in under-draining, using stone. This was a failure; the dirt washed in, and choked the drains. My land being mostly somewhat sandy, it washed in very readily, and that would not answer a good purpose. Seven or eight years ago I commenced draining with round tile, using inch and a half, two-inch, three-inch, four-inch, and five-inch tiles, according to the amount of water to be carried off. I followed it up during four autumns, till all my land that needed it, more than a mile in length, was drained. It works in the most perfect manner. I am satisfied, that, in some seasons, the extra produce resulting from the drainage has paid the whole cost for draining the whole farm.

I have made many improvements on my farm, but none which have given such entire satisfaction as this. The tile

was placed from twenty-two inches to four feet deep, generally from twenty-four inches to twenty-eight inches.

I have been astonished to see how soon the water begins to flow after a rain. I have seen a five-inch pipe, the outlet of one-third of a mile of drain, flowing at its full capacity, repeatedly, within one hour and a half after the commencement of a heavy rain, such outlet being entirely dry previous to such commencement.

I have had two or three conversations with Dr. Sturtevant of South Framingham in regard to this point, and he has told me of his lycimeter. He could hardly credit the fact that the water gets down to my drains and runs so freely in so short a time. I only know the fact that it is so. And perhaps another fact may somewhat explain it; that is, my land is somewhat descending, and the water, during a heavy rain or heavy shower, does not sink into the ground all the way, but tends rather to sink where these drains are. That is the only way I can account for it; but the fact is as I have stated.

I have always considered the feeding of my cattle and hogs as the most particular part of my business. I feed to cows in milk, fatting cattle, and hogs, all I can get them to eat, being persuaded, that, the more they eat and properly digest, the greater the profit. But they are required to eat all clean before having more.

As I use a good deal of manure, so, to make it pay, I employ considerable help. I have paid for that hired for the past ten years from about nine hundred dollars to about fourteen hundred dollars annually.

In hiring I have had a twofold object in view, — to employ good help, so as to make a profit on their labor, and to so use them that they would continue to work for me, and have an interest in my success. I have succeeded in both. One, as boy and man, has worked for me some thirteen years, and three others all the time I have had work for them during several years.

I have generally made no bargain with them, but have paid as my profits seemed to warrant. So far as I know, they have been entirely satisfied. I have paid higher wages, probably, than any other farmer in Bristol County, and have had workmen who have been entirely reliable.

I paid one man, for instance, during several years, three dollars per day, and furnished him dinners from about the first of April to Thanksgiving time. I pay less now, of course.

I would say that I have been criticised for paying such high wages. One man, I remember, asked me how I could pay my bills, and pay higher wages than others in the neighborhood. I have been entirely satisfied, because the results have been satisfactory to me. I endeavor to make my men take an interest in the business. I have never said a word to them to the effect that their pay would depend upon my sales; but it seems to be tacitly understood all round that the amount of wages will depend on the amount of my sales and profits. It will not answer in all cases. I have had men whom I did not want more than a day, if I could get rid of them. But the men I employ regularly, I really make take an interest in my success, and that seems to be a solution of the vexed labor-question.

I have stated that I endeavored to raise that which would be salable. I will now say, that at different times, as the demand seemed to warrant, I have made different products my principal crop. At first it was hay, then potatoes, next onions, and still later strawberries. In at least one instance I changed to my loss. A person should change from one branch of farming to another with caution. If he has attained to some skill in the cultivation of any crop, he should hesitate before abandoning that to try something about which he knows little or nothing.

Besides the above-named crops, I have raised corn, rye, oats, barley, squashes, turnips, asparagus, pears, grapes, cabbages, currants, and raspberries, all, of course, in a small way. The seasons that don't suit some of them must be remarkable. Although I raise several kinds in small quantities, yet I find it easier to dispose of a load of three or four different products in market than if it consisted of a single kind.

I find by looking at my books, that my aggregate sales amounted

In 1871, to	$5,513.42
1872, "	5,189.15
1873, "	5,071.79
1874, "	5,948.83

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Since then, my sales have been less, and so have the expenses.

I have mostly used wood for fuel, and, with but two exceptions, I have had at least one year's supply ahead in my wood-house. I cut it up and put it under cover green, to season there, and, thus served, two cords are worth fully as much as three cords burnt green, or left out over the year. If this be so (and I think there is not a doubt about it: I am as well satisfied of that as of any fact that I do know), then it is a matter worthy of consideration, as the saving of one third of the fuel used in one's lifetime is of importance.

Such savings or leaks make the difference between success and failure; and, if the history of many an unfortunate man could be known, it would be seen that his misfortunes did not spring from the ground, but were the natural, legitimate fruits of his own mismanagement.

One of the most astonishing and alarming facts of the times is, that so many of our young men, and young women too, leave the farm for the city to engage in something more genteel and fashionable. Various reasons are assigned for this; but *the* reason, doubtless sufficient to account for the whole mystery, is, the young people are brought up in an atmosphere of discontent. The burden of conversation between their parents at home and neighbors, when they meet, is, "Farming don't pay," "It is hard work," "It is too cold for crops to grow," "It is too wet," "It is too dry," "It is too hot," "It is the poorest season that ever I knew," "The frost will kill the corn," and, "I wish I could get something else to do." That I have heard sung a great many times. Such farmers, instead of attending to their work at home, spend their time at the corner grocery, declaiming against the hard times and the unprofitableness of their business.

It is not strange, that, as the children grow up, they leave a place and a business which have been the source of fault-finding ever since they can remember. But, aside from the temptations to which all such as go to the cities are exposed, facts show that farmers are much more certain of success than those engaging in other callings.

During the depression of the last few years the tide has set from the city country-ward, and it is to be hoped that the panics and failures, ruin and suffering, through which we have

been passing, may teach the lesson that a good comfortable home and living in the country are better than the anxious, feverish, sleepless strivings after wealth, in which so few succeed, while the most are doomed to bitter disappointment.

The fact may be here noted that the tiller of the soil is *not* looked upon as an inferior, because of his occupation; but if he be intelligent, enterprising, and a man of integrity, he not only *is*, but *is considered*, the equal of any man in the land.

But I must close; and, in doing so, I may say in general I have been industrious and economical. Man and beast have been amply fed, with no waste. I have attended closely to my business, yet have always been a heavy sleeper and late riser. I have not wholly deprived myself of the pleasures of reading. In addition to other subjects which I sometimes examine, I peruse regularly, and have for years, from eight to twelve news, religious, agricultural, and horticultural papers.

A word in regard to what is sneeringly called "book-farming." An acquaintance expressed himself as follows: "I don't believe in book-farming. Common-sense farming is good enough for me." Just so. But what is common-sense farming, except an application of correct principles to the business? And how shall we know those principles, without learning them? And how can we so easily learn them as from the words or writings of those, who, by experiment and practice, have found them out before us?

It was my misfortune to be born very ignorant, and, desiring knowledge, I sought it, even in books and papers; and I am free to admit that much of my success has resulted from hints and suggestions derived therefrom. Many of our so-called agricultural writers being mere theorists and visionaries, one should discriminate, and follow only the teachings of those who know whereof they affirm; and even correct teachings must be varied to meet our special circumstances of crops, soil, and climate.

I have often been asked whether I work very hard. I can answer, that we intend to labor ten hours per day, *with absolutely no work on Sunday*, except the necessary care of live-stock, and the saving of property unavoidably exposed

to loss. There has been no work for the latter purpose, I think, in twenty years.

I expect my hired men and myself will do as much as any other equal number of workmen; and we accomplish it by taking all the advantages of doing it in season, and by never taking three steps where two will answer.

I will illustrate this matter of taking unnecessary steps by supposing a case.

A man starts for a distant field to cultivate and hoe. On arriving, he finds his whippletree was left at the tool-house. Some one must go for it. Sharp words, perhaps, are said at the forgetfulness of him who should have taken it. The day thus commences unpleasantly. By and by the heat and labor occasion thirst, and it is found that no drink was taken to the field, but must be sent for. After the man who does the cultivating has completed that, he is to work with the others; but his hoe was forgotten, and must be sent for. The farmer who does thus in one thing generally does the same in many, and he may work till doomsday without accomplishing much.

A little forethought will save hard work.

I have already stated that I consider farming the most promising business in which a young man can engage; but if he expects to get his living at it by his wits, and not by his labor, he will find his stock in trade insufficient. If he thinks of getting a dollar, as Horace Greeley said, "short of fairly and squarely earning it," he may some day read in the papers, under the head of business embarrassments, something like the following: —

"Failed, John Blank, farmer. Liabilities, $7,000. Debts secured, $250; unsecured, $6,750. Assets nominal."

I know it is objected that farm-labor is exhausting: that depends. Doubtless many farmers do work harder than they should, and so others may. Please name the occupations, either of mind or body, at which a man can not or may not work to the extent of exhaustion.

I came near omitting two matters which may have essentially affected my whole life. I have used neither liquors nor tobacco. Those who have used one or both may figure out what I have saved thereby.

It has been often charged, that, in farming especially, men

record nothing but their successes, while their failures are never heard of.

Candor compels me to admit, however humiliating it may be, that I have often been like one groping in the dark, and have made blunders and mistakes, which, if made by a hired man, would have tempted me to discharge him. On one occasion I nearly ruined my early potatoes by applying a compost of fish-guano and loam, in which there was too little loam, directly to the potato. Again: I destroyed another planting of early potatoes by putting nitrate of soda in contact with the seed; and twice I had to reset my strawberry-fields, — once by putting super-phosphate too near the roots, and in the other case by using bone and ashes in the same way. I might mention other instances in which lack of knowledge has occasioned serious losses.

On the other hand, favorable conditions and circumstances have made some of my crops very paying. I sold, one year, potatoes from an acre and a half of ground to the amount of a little more than six hundred and sixty-nine dollars. And again, on a field of two acres, I applied in the fall, and ploughed in, seven tons of fish-guano from the oil-works, and in the following spring a good dressing of manure was also ploughed in. It was set to Wilson strawberry-plants, rows four feet apart, with early potatoes between the rows on one acre, and early cabbage on the balance. That season the maggot very generally destroyed early cabbage in our vicinity; but mine mostly was unhurt. I sold the cabbage and potatoes for eight hundred and thirty dollars.

On that field, the year following, the strawberries were sold for $2,606.51, and the year succeeding that for about $2,100; but all this was in times of inflated prices. Whether my business was more or less profitable, I kept steadily on; and although a paying crop would stimulate, yet an unprofitable one would not dishearten me. Notwithstanding the frequent mistakes, I have, to the best of my knowledge and ability, applied business principles to my farming operations.

And now for the financial results. In 1869 my farm was paid for. It was in a fair state of fertility, and bearing good crops; it was stocked with team and tools, and I had laid aside three thousand dollars. Since then, I have put in

the under-draining which was mentioned, costing some four hundred dollars, built a cold grapery at an outlay of about two hundred and fifty dollars, set out and brought into a good state of productiveness two acres of asparagus, made some other improvements and repairs, and laid aside (with the exception of the present year, which is yet incomplete) a yearly average of fifteen hundred dollars. It is unnecessary to say, that, with my treatment, my farm is worth more now than I paid for it.

I will say, in conclusion, that I love my business; and if all the occupations known to man were presented for my choice, and could I perform equally well the duties of each, I would unhesitatingly select that of farming.

The CHAIRMAN. Gentlemen, the subject is open, and we shall be glad to hear any who desire to speak upon it.

MOSES HUMPHREY (of Concord, N.H.). I did not come here to occupy any time, but to hear what you had to say. This was my native town; and, though I left it thirty-five years ago for New Hampshire, I still have a love for the old place, and it is very gratifying to meet the friends of agriculture here. I left the farming of the town in a very low state, and I am glad to see and know of the improvements that have been going on here.

I was very much pleased to hear the experience of the gentleman who has addressed us this morning; but I suppose you all understand that you are very favorably situated in regard to market-gardening, and that we in New Hampshire, living back in the country, have not the same advantages that you have: therefore we are obliged to come down to the staple crops. The question with us in New Hampshire is, What can we most profitably raise?

At the meetings in different parts of our State we have to come down to the raising of corn, grass, and cattle, the making of cheese, and so on. Generally our meetings are very practical. We do not have many scientific people among us; and, when we do have them, we generally have to come to Massachusetts to get them. We are always glad to get them, and we get a great deal of valuable information from them.

Now, as this meeting is an inquiry meeting, perhaps you will allow me to speak upon the subject of corn. I am

somewhat of an enthusiast, perhaps a little wild, on that subject. I have given it thought and study, and have tried some eight or ten experiments in raising corn, and I have come to the conclusion that we in New Hampshire can raise corn; and I tell the farmers there that we can beat the West. The time is coming, before many years, if we keep on in the progress we have made, when we shall have corn for exportation. When we commenced on the subject of raising corn, we were paying out about three millions of dollars annually for corn alone. Now, the question came to my mind, Where does New Hampshire get the three and a half millions to pay the West every year? I found that the proceeds of our timber and of our farm crops were going West to build them up, to our destruction. But I think we have turned the tide. That is my opinion, from the fact that there is a large amount of corn now raised in the State. In the city of Concord I can put my hand on one man who raises twenty-five acres; another, ten; another, five; and they all raise it at a less cost than I can. I raise mine for thirty-three cents a bushel,—six hundred bushels. My neighbor Mr. Walker, who raised about the same amount, goes considerably under me. A gentleman in Pembroke, a very reliable man and a good farmer, had twenty-four acres, and he tells me it cost him a great deal less than that. He got a hundred and seven bushels on one acre. He is a very reliable gentleman, one of our county commissioners, and I think his statement may be taken as correct. I raised a little over nine acres this year, averaging sixty bushels to the acre. I could have got more than that; but I thought that was about the point where it was most profitable. For instance, I have put four acres on barnyard-manure and four acres on the Stockbridge fertilizer, side by side, testing them to know which was the best. The barnyard-manure was of the same value precisely as the Stockbridge, reckoning the manure, twenty cords, at six dollars a cord on the land. I found the results about the same. I have tried that experiment for two years.

My crop, as I say, cost me thirty-three cents a bushel. In making up that amount, I want you to understand that I charge interest on the land, I charge all the taxes, I charge for every day and every hour of labor upon the land, and I give credit for the fodder or stover at so much per acre

or so much per ton, making, if I recollect right, about thirteen dollars per acre for the fodder: that leaves thirty-three cents a bushel as the cost of my corn, on the average. Now, I would like to say this: I have got from that Stockbridge manure, on four acres, a crop of corn that cost me thirty-three cents a bushel; I have got all the fodder that comes from four acres to feed to my cattle, and I shall have all the manure that my cattle make to go on and increase my crops hereafter: therefore it is only a matter of time to bring up those farms that are adapted to concentrated manure to a standard where we shall not need such fertilizers, having enough barnyard-manure to meet all the requirements of crops.

I think we have got up to a pretty good standard in raising corn. If you look at the statistics, you will find that New Hampshire stands ahead of any other State in the United States in the amount raised per acre. We stand forty-two bushels and a half per acre, and no other State comes up to forty bushels. One reason is, perhaps, that, since we have agitated the question of raising corn, almost every man who has the name of raising corn has striven to get the most per acre at the least expense, and of course our average is large. Mr. Walker of Concord (who owns a large farm, and is an experimental farmer and very successful) tried the experiment this year of ploughing his land up, and putting on the usual coating of manure for a series of crops five or six years. He took an acre right opposite this land, of the same soil precisely, ploughed it, and put on no manure except a little phosphate in the hill. From that acre, with a little phosphate in the hill, he got as much within two baskets as he did on the other piece which was manured in the usual way for six years' crops. Why was it? I went on the ground and saw it. Where his land was manured for six years, there was an immense growth of fodder, so that you could hardly get through it: on the other, there was just stalk enough to bear two ears of corn. Mr. Walker and I are very good friends. He thinks I am pretty fast in this matter, and he is inclined to be conservative. He tries one experiment, and I try another; and out of these experiments we hope to get results that will be a benefit to New Hampshire, and perhaps the benefit may extend out a little farther.

Now, I want to say a word about the constant grumbling we hear among farmers, to the effect that farming does not pay. It is one of the worst possible evils in a farming community; it tends to make the boys and girls dissatisfied, and induces them to leave the farm and go off somewhere where they think they can live better or easier. I met an old friend here, who has been to sea all his life, and he said he had bought a farm in this vicinity. I told him that was the best move he ever made in his life. I am glad he has had the good sense to take such a step.

QUESTION. What kind of corn do you find most profitable?

Mr. HUMPHREY. Eight-rowed corn, very similar to the red flint. Mr. Walker has raised twelve-rowed corn for several years, and has argued in favor of it; but last winter he said to me, "If you will let me have enough of your corn to plant four acres, I will try that by the side of my large corn." I picked out of my bin enough of the best ears to plant four acres, and carried them down to him. The result was, he got three or four, or five or six, more baskets of the eight-rowed corn from an acre than he did of the twelve-rowed. He is going to keep that corn until spring, until it is thoroughly dried, and then shell and measure it, and I think he will get some results which will be valuable as to the best corn to raise.

QUESTION. Is your variety yellow?

Mr. HUMPHREY. Yes, sir. I raise the yellow, eight-rowed corn, of the smallest cob and the least stalk. I don't want to raise fodder. I want to raise corn: that is what I am after.

QUESTION. Is it not profitable to raise fodder?

Mr. HUMPHREY. I have no doubt it is in some cases, but not as I am situated. If I had a milk-farm, I should do it. My land is adapted to corn, and I should raise fifty acres if I could get rid of the fodder. The Stockbridge fertilizer seems to be adapted to my land; to Mr. Walker's it does not. His land is heavier than mine. He tried it on rather wet land, for grass: my soil is lighter. I have, I think, some seventy-five acres adapted to the Stockbridge fertilizer, if I could only get rid of the fodder. I believe I can raise corn for fifty cents, and then beat the West, if I burn up the fodder. I think the dependence of New England

upon the West for corn and wheat is entirely wrong. We ought to raise our own wheat wherever we have land adapted to it. I know that all land is not adapted to it; but there is more land adapted to it than we think. I know you do not have mills to grind it as we do.

Mr. Cushing. Do you advocate letting the stover and cobs go off the farm when you raise corn?

Mr. Humphrey. I sell but very little. I would sell it if I had an opportunity, and buy the Stockbridge fertilizer.

Mr. Cushing. I consider that those are the very ingredients we want on the farm to make corn grow again. I raise a little corn every year. I should differ with the gentleman in regard to raising corn on sward-land. Last spring, I turned over a piece of sward-land, where the grass had been killed by the dry weather, put on a little manure, and put a compost of ashes and hen-manure in the hill; and, although the land was not ploughed until the 10th or 15th of June, I raised seventy or eighty bushels to the acre. I cart my stalks into the barnyard, drive my teams over them, crush them, and make them soft, and, by the time cold weather sets in, I have a compost-heap that will be worth carting out the next spring. All the slops from the house are conducted to the barnyard, and the drainage from the yard flows on to a meadow below. I don't think it is good economy to allow the corn-butts, &c., to remain in the field to check the plough. I think the best plan is to turn all the stover that the cattle won't eat into manure for next year. It used to be a saying with my father, that a corn-cob that came out of the hog-pen with a little excrement clinging to it would raise a good hill of corn. They call this *modern* farming; but the old farmers had some of these ideas that we have now. I think the old people should have a little credit for the lessons we are getting now.

Mr. Humphrey. I want to be understood fairly about my corn. I should have had, probably, seventy-five bushels to the acre, which I usually get; but the drought took a portion of it, the grasshoppers took a portion, and the squirrels came in and took a portion; so that my crop was much reduced.

Question. I would like to inquire as to your method of harvesting.

Mr. HUMPHREY. I cut up my corn, and stook it, and as soon as possible get it under cover. This year we had a very remarkable season, and I think my fodder is as bright as it could be. I never top the stalk; for that I consider labor thrown away. It is no advantage to the crop, and the fodder is not so good, nor worth so much.

Mr. PERRY. Have you ever known good results to follow from the use of artificial fertilizers on clay soils?

Mr. HUMPHREY. That question frequently comes up in our meetings. So far as my knowledge goes, on heavy, clay soil the general complaint is, that the Stockbridge is a failure.

One word, if you will allow me, in regard to keeping hogs. I would keep hogs if I did not get one mill for them, for the work they do and the manure they make.

Mr. PETERSON (of Marshfield). Perhaps it would be proper in this connection, as the matter of manure and fertilizers seems to be a main consideration in farming, to mention, that in my vicinity there is a large tract of land that has been reclaimed from the ocean (and that is only part of considerable land alongshore similarly situated), that does not require any manure to raise large, heavy crops. I have been requested to make a simple statement in regard to that tract of land in my vicinity which promises such valuable results to the farming community; and I am induced to comply with the request, particularly for the reason that I have seen, just below, a tract of land similarly situated, which undoubtedly would produce like results, if the ocean could be shut out from it.

The marsh in my vicinity comprises about fifteen hundred acres, which has produced nothing but salt hay for the last seventy-five years or thereabouts. It has been diked, and the water shut out. The depth of this rich deposit varies from six to ten feet. Seed has been put on and harrowed in, and the most gratifying results have been realized. Red-top and Timothy yield three tons to the acre; barley, wheat, oats, and rye give very heavy crops; turnips, carrots, beets, potatoes, onions, melons, and squashes have been grown in profusion, and all without special fertilizers: in fact, where fertilizers have been applied, they have been without any apparent benefit. I set out as an experiment, some three

years ago, a few strawberry-plants on the banks of one of those creeks which is in the main body of the marsh. The first year an invading army of grasshoppers swept this green carpet of vegetable growth; but the strawberry-plants withstood the plague, and grew considerably the next year; but the grasshoppers destroyed the fruit. The last season, the insects left for parts unknown, and the strawberry-plants commenced to show berries late in June. Many of you may know — most of you, perhaps — that a local drought, reaching from our shore south-westerly, more persistent than any known, has prevailed for the last two years, which, of course, scorched our strawberries on the uplands before the first of July; but the berries on the marsh kept right along, and grew luxuriantly the present year until the 10th of July (one berry measured four inches and a half), and all without any culture, with the exception of pulling a few weeds, which grow rank, as all plants do, on that soil.

Our discussion yesterday convinced me that the main problem to be solved is, How shall we feed our crops? We all know that fertilizers are costly things, unless managed with intelligence and judgment. It seems to me that there, and on lands like those, if anywhere, can be solved the problem of labor for the farmer, at least it will in those localities ease his way along until we have more light on that subject.

Mr. SLADE. — Will the gentleman tell us what the process is for preparing the land for cultivation, and for shutting out the salt water?

Mr. PETERSON. I think I may say that it has been found that the surface of that land is more available at present for plant-growth than the soil lying below; and, where the seed has simply been put on and harrowed in, there have been heavy crops, perhaps as heavy as any obtained by ploughing and pulverizing. But that soil varies from eight to ten feet in depth, and at some time will be available all the way through for plant-growth.

Mr. SLADE. How do you get potatoes on it?

Mr. PETERSON. By simply putting them in and letting them grow. Not *letting* them; but they do grow.

Mr. HUMPHREY. Do you plough the land at all?

Mr. PETERSON. There has been considerable experiment-

ing, and the plough has been put through at considerable cost, though there are no stones to obstruct; but the general impression is at present, that it had better be decomposed by the simple process of putting the seed in on the surface.

Mr. CHEEVER. I feel as though, on behalf of the farmers of Massachusetts, the laboring, every-day farmers, I ought to thank Mr. Paul for coming before us to-day as he has, with his account-book. Many of us whose property is in land, and exposed to the assessors, have had reasons, and good reasons, for keeping our books closed; and some of us have been more successful than we wanted to talk about much. But here is a working-farmer who began with nothing, running in debt for his farm, and his stock and tools; and he has told us how, out of the produce of that farm, he has paid for it, stocked it, supported himself and family, paid the men in his employ at better wages than have been paid by his neighbors, and has come out very successful: I cannot call it any thing less than that. We are told that farming does not pay: we have all heard that a thousand times. We have been told repeatedly that if a man will sell his farm, put the money in the bank, and go out to work, he will make more money than he will by farming. We have all heard it said, that, if we figure up the profits of farming, we must throw away all our labor, and throw away all the interest on our capital. The discussion seems to be wandering from the subject of the essay, and I would like to ask Mr. Paul what interest he finds his farming has paid him on the investment. If he is willing to state the figures, it will answer a question that hundreds of farmers ask themselves, and help us some.

Mr. PAUL. Without going into it more carefully than I can here, I cannot tell exactly; but making a rough calculation, putting my labor against the support of myself and family, letting one balance the other, it is at least fifteen per cent on the investment. I will say, taking the capital from 1869 (when I had paid for the place) up to the present, at least fifteen per cent, and perhaps more than that.

QUESTION. What is the cost of the manure at your place? Is it "coarse manure," as people generally call it in Boston, or fine manure?

Mr. PAUL. The manure that I am purchasing is what is

called "rotted manure;" and it costs me at my place about seven dollars a cord, — a fraction more. It has cost eight dollars and six cents until this fall, when I have got a reduction on the freight (three dollars and twenty cents being the regular freight) and also on the price. Mr. Dole charges five dollars and a half a cord by the small quantity; but, in quantities of fifty cords for cash, he sells it for five dollars and a quarter. I have bought of him for several years, and have made a little better terms; so that he sells it to me for a little less than that, delivered on the car.

QUESTION. You spoke of having made mistakes in changing crops. Would you be willing to state what those crops were?

Mr. PAUL. One in particular. I raised onions previous to the war, and it was my fortune to stop raising them at the very time during the war when they went up to two dollars a bushel in the fall; and there were two years then when they were sold as high, I think, as twelve or fifteen dollars a barrel in the spring. I think they went from a dollar and a half to two dollars a bushel during the season. There is one serious mistake I made. I omitted raising them for a few years, and I have always regretted it. I think that is the case with many farmers. We make changes at the very time we ought not to make them, and we do it because prices are low; and everybody changes about that time, and the consequence is, prices go up. My experience is, that you had better continue to cultivate any crop that you raise. My idea is, and I form my opinion from my own practice, that the average price right through will pay, in almost any department of farming we see fit to go into. I am fully persuaded of that. I was talking with my brother-in-law, who has been into New Hampshire and Vermont for cattle, horses, and sheep, and he told me that he knew farmers there who had raised cattle, horses, and sheep; and some of them who had been raising horses, when they were at a low price, comparatively, and neat-cattle were at a high price, would leave the horse-business, and go to raising cattle. They sold out their horses at the time of low prices, and purchased cattle for stock-raising when the prices were high, and, by the time they were ready to supply the market, the price of neat-cattle was down, and then they went into

sheep, and so on around the circle. They always went in at high water and came out at low.

QUESTION. You were speaking of draining land. Might not the difference between you and Dr. Sturtevant be accounted for by the less porous nature of his soil, the water flowing quicker through your land than through his?

Mr. PAUL. I don't know but it might. That was rather loose soil, and it is possible that was the case. I am sure I don't understand it; but the fact is there still.

Mr. WILLIAMS (of Waltham). I would like to ask the gentleman how much capital he had invested the first year that he made fifteen hundred dollars besides his living.

Mr. PAUL. I have made a rough estimate of the average amount of capital since I have been making that amount yearly, and it was about ten thousand dollars.

Mr. WILLIAMS. The first year it was less than that?

Mr. PAUL. It was less than that the first year. You will understand that prices a few years ago were higher than at present, and a given amount of capital paid a larger per cent.

Mr. WILLIAMS. Now I would like to know in what profession or what business, interest on invested capital is reckoned in the way this gentleman does. If you invest ten thousand dollars in any business, and want to ascertain what per cent it pays you, you do not take your living, your house-rent, and the clothing for your family, from your income, and then get the interest on your investment; so that it seems to me, that, instead of fifteen per cent, he could double that as the interest on his investment. I merely bring that up that we may understand this matter. When we compare the money invested in agriculture with the money invested in other pursuits, or the men engaged in agriculture with the men engaged in other pursuits, we compare an unsuccessful farmer, as a rule, with a successful business-man or a successful professional man, which is unfair. If we are to make a comparison, let us put each profession upon the same basis.

Mr. FLINT. Mr. Paul expressly stated that he offset his cost of living by his labor.

Mr. WILLIAMS. I say that in no other case where you invest money do you do that. If a merchant invests a hun-

dred thousand dollars in his business, and makes ten thousand dollars outside of his family expenses, he says that that capital has made ten thousand dollars, or ten per cent. He does not take his living out of that to get at the interest on the investment.

Mr. FLINT. He does not reckon his labor any thing, and Mr. Paul says he offsets the value of his labor against his living.

Mr. WILLIAMS. I know. So I say that he makes a larger per cent than the merchant who reckons his interest in the way I have stated. In addition to his living, he makes his fifteen per cent.

Mr. WHITAKER. I am glad that Mr. Flint and Mr. Williams have found another subject to disagree upon. We all disagree about farming. Mr. Cheever said that he had almost given up, because there was so much disagreement that it seemed as if farmers would never come together. Now, I think that if as many men were brought together representing the mercantile interest as come together representing the farming interest and they began to discuss any subject, we should see quite as remarkable a disagreement as we see among farmers.

I do not like to disagree with any man who comes from out of the State; but Mr. Humphrey said that up in New Hampshire they came down to practical questions, and threw scientific matters out of the question; that they liked to have scientific men up in New Hampshire, but did not care much about scientific men.

Mr. HUMPHREY. I think you misunderstood me. We appreciate scientific men; but we do not have them among us so much, and we come down to practical questions.

Mr. WHITAKER. I am glad I misunderstood you; for I was going to say, if you ever have a scientific man come to New Hampshire, who is not a practical man, send him home as quick as possible. I tell you, if science is not practical, it is good for nothing: you might just as well dispense with it at once.

There is another point that Mr. Paul made, which is an excellent one, of which I want to speak. He says that he has lost by changing from one crop to another. I think there are a great many losses made in that way. If you go to our manu-

facturers, you will find that their changes have absorbed a large amount of their profits. There are few who will struggle along through a losing year. The remark was made this morning at the breakfast-table, "Last year was a very poor year for cabbages. This year people kept out of them, and we have a great deal better year for cabbages." I made the remark that next year would be a very poor year for cabbages, from the fact that people will say, "Cabbages did well last year: I am going for them this year." They will go for them, and cabbages will be very likely to be an unprofitable crop. That is the way in manufactures. Men see that a certain man is making money on a particular line of goods, and they say, "We will go into the business of making those goods." But, just as soon as they get ready to put them on the market, the price has declined, and there is no profit in them. A friend of mine who was manufacturing blankets, finding that blankets were low, thought he would change his mill so as to make flannels, and did so at a cost of ten thousand dollars; but, when he had got fairly at work on his flannels, he found that blankets would pay him a great deal better. I have had some experience in manufacturing; and I have found that those men who made a specialty of one thing were likely to succeed a great deal better than an individual who was constantly changing from one thing to another.

I once attended a farmers' meeting in New Hampshire, and one old gentleman got up and said, "They talk about farming not paying. I have heard that talk ever since I was a boy; and sometimes I should be almost forced to believe it, but for this fact, — when I started farming, I had nothing: I had to run in debt for my farm and for my stock. I have brought up a pretty large family, and have given them a good education; I have got my farm paid for, and my stock is paid for, and I do not owe a man a dollar; and this," he said, "is not only my case, but that of many of my neighbors who started out young men about in the like condition, and who have done about the same as I have done."

Mr. DAVENPORT (of Colrain). I wish to say a few words in regard to the idea of changing business. As far as my experience goes, it is not advisable to be changing from one kind of business to another. But one good rule I have

always found in changing business, and it is a little contrary to the common rule among Yankees; that is, to watch the market, and, in case you find one season the market glutted with any kind of produce, the next year you had better raise as much as you can of that kind of produce. Yankees generally quickly leave the cultivation of that article; and the Yankee who is shrewd and wide-awake will go into it, and therefore will make more money. I have a brother in Hartford, a very successful farmer, and he makes that his rule. He cultivates somewhere from fifty to sixty acres each year in this way. For instance: a few years ago, the market was glutted with cabbages; the next year he raised five acres, and sold his crop for five thousand dollars. He has followed that practice; and, in my farming, I have kept along in the same line, raising stock, keeping about a dozen cows (never selling any calves, but raising the whole of them), and raising sheep. Sometimes I have a hundred sheep. When one part is up, the other may be down, and so I continue on in the same line. I have raised horses some; but I don't think I have been successful with them. I would not advise people to go into that business, judging from the experience of my neighbors. I have in mind two young men who had a very nice farm left to them worth twenty thousand dollars. They went into horses. They did not work any themselves. And let me say here, that one reason why farmers are not successful is because they do not work themselves. I calculate to work twelve or fifteen hours a day, and I think if a farmer will work with his men, and say, "Come," instead of "Go," he will be successful. These young men to whom I refer staid in the house and told their men to go to work. One neighbor kept thirty horses, and in a few years his farm was gone: the savings bank took it, and his friends would have had to furnish him money to go out of town, if he had not gone out before. Another had a farm worth twenty thousand dollars: he farmed it along twenty years, and his friends furnished him money to go West, and he left his farm in the hands of the savings bank. This is the experience in my neighborhood in raising horses.

In regard to raising corn: I have never thought, as our friend from New Hampshire suggested, that it was a good plan to raise the same crop on the same land year after year;

but it may be on light soil, when you are going to apply manure to the whole of it. But my plan is to cultivate ten acres, plough it up, raise two crops, seed it, and so go on with a rotation of crops. Grass is the best crop I raise.

The matter was talked over here yesterday, when we should plough. I have had the best success in turning over my land in August. I turn it over, put on the pulverizing harrow and the manure, seed it right down again, and roll it down smooth. I have got the best crops of grass in this way, and got the best return for my manure. I turn over the ground, instead of top-dressing it, unless the land is moist. I have some land that is moist enough, so that I think it pays to top-dress it; but on most of the land in my vicinity it is better to turn it over, put on the manure, and then seed down, without any grain-crop. I think a great many make a mistake in putting on grain to take part of the goodness of the manure, because, in our vicinity, — and it has been so, I think, for the last few years, — a good crop of hay is worth more than a crop of grain, and does not draw on the land so much.

In regard to the application of manure, I think one mistake is in putting it on late in the fall, when the ground is frozen. If it is on land that is inclining, then the rains will wash it away, because it cannot get into the soil; but if it is put on before the ground is frozen, when there is a good covering of grass, then that will absorb the manure, and the water that comes off at the foot of the hill will be clear. There is a river some forty or fifty rods below my barns, and the water goes down hill to the river; but it does not go many rods before the land absorbs it all. I do not think that any of it, except when the ground is frozen, gets into the stream below.

Mr. Slade. I have listened with a great deal of pleasure to Mr. Paul's experience in farming, as I suppose you all have. It has been my good fortune to live a neighbor to Mr. Paul; and I frequently visit him to take lessons in growing crops, applying manure, &c. We compare notes; and I consider him, and always have, very good authority.

Mr. Paul stated some cases where he had made blunders by changing his crops: he neglected to state, I think, wherein he succeeded by changing. Now, I pursue a certain line:

I grow certain crops; and I am going to stick to them until I perceive that there is more money in something else, and then I am going to change immediately. I think that that is the duty of all farmers. Mr. Paul stated in his remarks, that he had usually produced those crops that would most readily sell in the market to which he had access. I think that is the duty of every one. That is what I carry on the business of farming for. I farm it for the money I get out of it, and I raise those crops that I think will produce the most money, taking every thing into account. I don't mean a crop that will impoverish the land, or any thing of that kind; but the crop that I can get the most money out of is the crop that I raise. I think that Mr. Paul has changed, from time to time, from one thing to another, just as I have; and he has finally settled down on growing what he does, for the reason that there is more profit in those crops than in any others that he can think of. I think that every farmer should decide for himself whether he is growing those crops that have the most money in them; and I would suggest to our New-Hampshire friends that they think the matter over thoroughly before they decide that it is best for them to go to raising corn.

Now, Mr. Paul cultivates sixteen acres of ground. He is an excellent cultivator, and he has given, as you perceive, as good an account of his stewardship as it is possible, almost, for any man to give. He cultivates, as I say, sixteen acres of ground. Suppose he goes to raising corn, and raises sixteen hundred bushels (which would be a generous crop) every year, at an expense of thirty-three cents a bushel. He would still have twenty or twenty-three cents a bushel coming to him for the corn he would raise, and he would get three hundred and twenty dollars or three hundred and fifty dollars every year for his corn-crop. He could not show any such balance in his favor if he raised corn, as he does by raising something else.

My notion is, that New-Hampshire people can raise something that will net them a greater profit than corn. I cannot afford to raise corn. If I could get sixty bushels on every acre of land I have, and could raise it, even for thirty-three cents a bushel, I should go to the poor-house in three years.

Mr. Humphrey. I can live on it.

Mr. Slade. Well, perhaps you have a secret that I do not know any thing about. I could not live on it. It does seem to me that a man should not hesitate to change his crop, if he sees that another will pay him better. Mr. Murray told us at Haverhill, when he lectured on the horse, "I have changed my mind. In fact," he says, "I would not give a farthing for a man who cannot wake up in the night, turn over, and change his mind." There is a good deal in that. There was a time when I confined my farming operations to growing corn, potatoes, and grass. I succeeded about as well as my neighbors. I did the best I could any way; but I found that I could not live in doing that. It seems to me that there is nothing plainer than that the West should raise the corn and pork, and that we should raise something that the city or village close by will consume. That is the way it seems to me. It is no use for us to attempt to raise corn, or beef, or pork, because thousands and thousands of hogs that have been fed on corn that does not cost more than twelve or fourteen cents a bushel, can be brought here by freight-trains every day; and I think that it should be raised there, and we should raise those crops that are needed close by home.

Mr. Perry. Tell me what to raise.

Mr. Slade. I cannot do that. Every man, as has been said, must have brains, and exercise them. Science may do almost every thing for a man; but it will not furnish him with brains: it will simply furnish him with facts, which he is to look at. We come here and hear all these statements, year after year. One man says this, and another says that; and Dr. Nichols will tell us that science teaches so and so. Well, I don't know what a man would become, if he should follow all these directions. It is not intended that he should. They are all well enough; they are all helps: but a man must exercise his own brains. I was reminded of it yesterday afternoon. I did not feel like crying, because I have had such experience before. I had ploughed in thirty or forty cords of manure, and we were told it was all going down to China or Japan, or somewhere else, and, if it was, I should not get any crop. Two or three years ago, when our meeting was at Fitchburg, Dr. Fisher gave us a lecture on the cultivation of the grape, and in the course of his lecture

he said there was nothing that could be applied to a vineyard worse than horse-manure. Well, about the last thing that my man who carried me over to the depot said was, "What shall we do?" We were going to draw horse-manure from Fall River, and I said, "Manure the vineyard." When I got home, I found that they had manured about three-quarters of the vineyard. I said, "Stop right where you are." They wanted to know why. I told them I had heard from head-quarters, and I should not have any grapes where that manure had been applied. I had a Swede at work for me, and he said, "I will take off every bit of it." I told him I would let it alone and try the experiment. The result was, I had the best crop of grapes the next year I ever had in my life, Dr. Fisher's opinion to the contrary notwithstanding. Now, I have three acres that I have manured with stable-manure, and ploughed it in shallow, where I intend to set strawberries next year, and I really hope (I don't know, but I have faith to believe) that I shall have a good strawberry-bed, notwithstanding the manure was spread in the fall, and ploughed in.

Mr. HUMPHREY. The gentleman's argument is very good for this State; but it is not applicable to us in New Hampshire. He must understand, and my friend Paul also, that they are very favorably situated to dispose of their crops; but we in New Hampshire are not favored in that way. Take Concord, for instance. We have a market-gardener who supplies Concord and Manchester, and oftentimes sends his produce to Boston. Now, supposing the farmers around there all went into market-gardening, they could not sell their stuff. Suppose all the farmers in the neighborhood of Mr. Slade and Mr. Paul went into market-gardening, they could not make a living out of it. Their success in market-gardening is owing largely to the knowledge they have acquired in the business. Any man will be successful who has brains, and who will apply himself to his business intelligently and faithfully. I do not advise anybody to raise corn in large quantities, but to raise enough for his own use.

Mr. PAUL. I wish to say one word in regard to the application of manure, and that is, that I have never practised composting. I read very much in the newspapers about composting, and I have seen men practise it; but I

have never composted any of my manure, except, in some cases, fish-pomace: I think that is the only material that requires it. I always trust the earth to do the composting, and, if I can get it near the surface, I feel satisfied that is the better way.

There is one thought in regard to my application of manure in the fall, which Mr. Flint's remarks yesterday did not exactly touch. One of the reasons (I don't know that it is a valid reason), but one of the reasons why I choose to apply manure in the fall, and plough it in so shallow as I mentioned, is, that there are soluble fertilizing properties in it which readily wash out, and those are distributed through the earth more readily than they are if the manure is not put on the soil until spring. That is the idea I have, — that it washes into the earth, and the crop of the next year will more readily find it than when it is put on in the spring.

Dr. Sturtevant. I do not think that it speaks well for the activity of agricultural thought, that we can discuss the question of the application of manure in the fall or in the spring, and no one has taken the trouble, although we have so many experimenters, and an agricultural college, to ascertain whether one assumption or the other is true. One man says there is no loss of manure if it is applied in the fall; another man says there is a loss. How can you account for such discrepancies? The fact is, there is no loss, agriculturally speaking, as we ordinarily apply it, whether we put it on at one time or another, so far as we can reason from analogy, so far as any fact indicates. If you apply certain chemicals in the fall, you will find a loss under those conditions. If you apply manures in the form in which they are usually applied in the fall, the loss is not appreciable; and whether you get a crop or not depends on something else besides the mere fact whether any of the elements of that crop have gone out of that soil, or have remained in it. You are only fighting a single branch of the question, and not the whole question, as you come to it in practice. I will ask if there is any one here who has any fact which will show any loss of the fertilizing elements through the application of farm-dung under the ordinary processes of farming, — whether in the spring, summer, fall, or winter.

Mr. Perry. Why is it, that if you apply old, dry horse-

manure upon mowing-lands in very warm weather, you will never see any benefit from it?

Dr. STURTEVANT. If I have a horse that requires two pailfuls of water a day to keep him alive, and I give him two drops a day, I shall expect the death of that horse, even if I give him all the oats he can eat. I can put all the manure on my farm on my grass-land, and not increase my grass-crop, because I have only a certain amount of water to raise it. I can supply the water, and raise my grass-crop. There is a whole circle of sciences coming in.

Major PHINNEY (of Barnstable). One of the advantages in connection with such meetings of farmers as these is, that they afford an opportunity for the interchange of views upon these various questions, and we go home and apply the knowledge thus obtained upon our various farms. I sometimes think, when I am among farmers, of the old saying, "that he who makes two spears of grass grow where but one grew before is a public benefactor." I feel as though we were more particularly among public benefactors here. I am glad that our State has been doing something for the promotion of this great interest. I go home to my own county and see what has been done since the State Board of Agriculture was formed, twenty-five years ago. It was a sort of inspiration, growing out of this interchange of opinions in regard to the culture of crops, forestry, and the raising of fruits. Early in the meetings of the Board, the matter of forestry was discussed. I went home, and I found that the pitch-pine was perfectly adapted to that section of the State, and I commenced planting that tree. My friends said that my children's children might derive some benefit from the culture of the pitch-pine; but I have to-day, growing from the planting of the seed, trees that girth more than my body. And what has grown out of the movement that took place from the State's interest in agriculture at that time? The increase in assessable property in that county to-day is more than two millions of dollars, growing out of the growth of the pine in a few sections of that county.

Then followed cranberry-culture. I am not going to occupy the time of the meeting; but I want to show what has been done by the interchange of opinions among farmers. We found that we had soil, when we came to look over other

sections, particularly adapted to the growth of the cranberry. What has been the result of a few years' growth of the cranberry in that section? Last year we marketed from a few towns nearly three hundred thousand dollars' worth of cranberries, — just from the little county of Barnstable, the shores of Cape Cod, which people scarcely believed had any thing worth cultivating; and yet that crop has been found profitable. That grew out of the impetus which the State gave to agriculture at that time, and the interchange of opinions, such as we are making to-day; and, however diverse they be, still we shall go home and apply in our own farming operations the ideas which we think of value.

When we find certain farmers growing rich, and others poor, it is not always to be attributed to want of brains on the part of the unsuccessful man; but it may be owing to a difference of soil: and I conceive that one advantage that will grow out of the Agricultural College will be that young men will come from that college competent to go into various parts of the State, and analyze the soil, so that the farmers themselves will understand it. They have not been able to tell what crops were adapted to their soils; but, with the help of the young men who will grow up there, they can determine that question, and great benefit will grow out of that.

I think these discussions of the various matters connected with our farming operations are valuable. We go home and carry with us the views, and opinions of our associates, and a little additional inspiration.

Mr. Flint. I want to make a single remark in explanation of what Mr. Humphrey has stated, that there is a difference in the operations of the State Board of New Hampshire and the State Board of Massachusetts. There really is not any practical difference between their methods of operation. The State Board of Massachusetts holds every year as many as twenty or thirty farmers' institutes, — not protracted three-days' meetings, like this, but meetings occupying one day, morning, afternoon, and evening. Some years ago, the Board passed a vote requesting the county societies receiving the bounty of the State to organize farmers' institutes within their limits, agreeing to furnish whatever assistance they could, and to do whatever they could to help them

along. Last March and April, something like fifteen or twenty farmers' institutes were held under the auspices of the Board, but directly by the county societies. I attended quite a number myself; and a good many members of the Board, also, were present at those institutes, and I think they did good. This year, something like a dozen or fifteen are already arranged for, and in one day I had requests to attend seven that are to come off this fall. I have already attended one or two recently. The county societies have generally fallen in very cordially with the request of the Board, and they are holding more or less farmers' institutes every year. So that really there is no difference in our methods of operation, except that, in the case of our Board, we think the details of the work can be done rather better by the local societies. In every case, however, more or less of the members of the Board have attended those institutes, as many of the members here present very well know.

Mr. Humphrey. I am glad to be corrected in that matter. I was aware that meetings were held in different parts of the State; but I did not know that they were held under the auspices of the Board.

Mr. Flint. I have no doubt that there will be forty institutes held around the State this winter, which will be just as much under the auspices of the Board as the meetings in New Hampshire, except that the local arrangements are made by the societies. I have been willing and glad to attend as many of these meetings as I could without interfering with my other duties as Secretary of the Board.

Adjourned to two o'clock.

Afternoon Session.

The Board met at two o'clock, and the Chairman introduced Hon. Edmund H. Bennett of Taunton.

SOME OF THE LEGAL RIGHTS AND DUTIES OF FARMERS.

BY EDMUND H. BENNETT OF TAUNTON, FORMER MEMBER OF THE BOARD.

In an article upon the rights and duties of farmers we shall naturally be expected to treat of those rights and duties which are peculiar to farmers, or rather such as are peculiarly important to them; and, if you find me unusually dry in the presentation of it, you will remember that it is an unusually dry subject; though, to those pecuniarily concerned, not wholly devoid of interest. And naturally the first inquiry is

HOW TO BUY A FARM.

It is quite generally known that a mere oral bargain for a farm is not binding in law upon either party; but it may not be so well understood that an offer to sell a farm for a given price, even though it be by letter or other simple writing, is not binding upon the proposer until actually accepted by the buyer, and he has also agreed to take it, and pay the price stated in the offer: therefore the owner may retract his offer to sell at any time before it is accepted and he is notified thereof (4 Johns. 235). And although, in making his offer to sell, he should expressly give you a certain number of days in which to decide, he may, nevertheless, change his mind in the mean time, if you have not accepted, and sell to another who offers a higher price, even before the given time has expired; and you would have no legal redress for your disappointment.

Nay, more; although you had fully made up your mind to take the farm, but had not notified the owner of that fact, and should go to great trouble and expense in buying stock, tools, agricultural implements, &c., to carry on the farm, and should even move your family there to take possession, the owner might even then refuse to sell, and you would have no legal remedy either to compel him to convey, or for the

expenses you had thus incurred relying upon his keeping his word. The only safe way in such cases is to take a *bond* for a deed, as it is called. An ordinary "refusal" of property, as it is termed, is a dangerous thing to rely upon, unless you are dealing with a man whose "word is as good as his bond," and they are very scarce. And, if a particular time is given you in which to accept an offer to sell, you should be particular to signify your acceptance strictly within the time, and to do so entirely unconditionally and without any qualifications, but exactly as it was made. In one instance a man had ten days in which to make up his mind, and on the night of the last day, about half-past eleven at night, he called at the owner's house, after he was abed and asleep, and said he would take the farm. The owner refused to get up, or to take the money the next day, and the buyer tried to get the farm by a suit-at-law; but it was decided that he came too late on the last day, and he not only lost his trade, but had to pay the costs of his suit (26 Miss. 309). In another case A. wrote to B. he would sell him his farm for three thousand dollars cash. B. wrote back immediately he would take it, if A. would make out his deed and send it to a lawyer for examination, and, if all right, the lawyer would pay him his three thousand dollars; but it was decided that B. had not duly accepted A.'s offer, because he did not enclose the cash in his letter, but asked A. to carry his deed to a third person for examination, and consequently that A. might withdraw and sell to another party (53 Me. 511).

But, supposing the grantor is willing to give you a deed, it must have the seal of the grantor attached, or it is not sufficient. A scroll of the pen, or the letters L. S., are not sufficient in Massachusetts, as in some other States. It may not be as well understood that it is not equally necessary that a deed should be witnessed or acknowledged, and recorded. These last two requisites may be essential to make the deed valid against the creditors of the grantor, or any one who subsequently bought the farm without knowing of the prior deed; and they are always so important they should never be neglected: and my first advice to you is, that, if you find any unrecorded deeds among your papers when you go home, you attend to that duty forthwith. Having once obtained a sufficient deed, the next question seems to be,

HOW FAR THE FARM EXTENDS,

or its proper boundaries. Three circumstances have more or less weight in determining this question: 1st, The number of acres stated in the deed; 2d, The length of the boundary-lines running round the farm; 3d, The area enclosed within the visible monuments, such as trees, rocks, stake and stones, described as corners of the farm. Of these three, the last is by far the most important, and, in case of any difference between them, controls all the rest. If the boundary-lines are described as beginning at a certain stake and stones, thence to a certain tree, thence to a particular rock or stump, and so quite around the farm, the deed conveys all the land inside of those monuments, although it be many more acres than the deed calls it; and, on the other hand, it will include no more, although the number of acres be much less than stated in the deed. So, if the monuments named are fixed and definite, they control the length of the side-lines mentioned in the deed; and if these be called a hundred feet long on every side, but the trees, rocks, stake and stones described as corners, are only ninety feet apart, the buyer will acquire a lot only ninety feet square, and not a hundred feet; and, *vice versa*, if the lines are described as only ninety feet long, but the given corners are a hundred feet from each other, the deed covers a lot a hundred feet square.

The quantity of acres mentioned is the very weakest means of knowing the real extent of the farm, even if the words "more or less" be not used, as is so commonly done; and, generally speaking, a deficiency in number of acres gives the buyer no remedy against the seller for any return of part of the purchase-money, unless, perhaps, when it was clearly bought at the rate of so much *per acre* (19 Pick. 387). So much more important are the known monuments and boundaries than the number of acres stated, that, even if the vendor fraudulently and intentionally overstates the quantity in order to deceive the purchaser, the latter has no redress, if so be the other truly pointed out the boundaries in making the trade (102 Mass. 217); whereas a fraudulent statement of the *boundaries* would release the purchaser from the sale, although the farm contained as many or even more acres than the parties called it in making the bargain (9 N. Y. 183).

And, while speaking of fraudulent statements, perhaps I ought to warn you that fraudulent misrepresentations by the seller of a farm, as to how much hay or wood it will cut, how much stock it will keep, how much it had cost, or how much somebody else had offered for it, though made with intention to deceive you into a foolish trade, are not in law sufficient to excuse you from the purchase, or give you any redress, when you find out the deception (2 Allen, 212; 5 Allen, 324; 8 Allen, 334; 102 Mass. 217; 63 Me. 12). Such and other similar statements are considered in law merely as "dealer's talk," which, though not to be commended in the code of morals, the law takes little or no notice of. On the other hand, if he should falsely state that the farm *had* cut fifty tons of hay, when he knew it had not, his deception would make him liable; and the line is so thin between actionable fraud and the contrary, that experiments in that direction are rather dangerous.

If a boundary-line runs to a tree, rock, stump, or other similar object, it ordinarily goes to the centre of the object; if it runs by a wall or fence, it passes along the middle of it, and not by the side, which, in a "Virginia fence," might be of some consequence.

So if the farm bounds by or on a brook, river, stream, &c., it usually extends to the middle of the current; not always to the middle of the *water*, but to the thread of the stream, — *ad filum aquæ*. If there be any islands between that centre-line and the bank, they belong to the owner of the main bank. In like manner, if a deed is bounded on a mill-pond, reservoir-pond, or any artificial pond through which a perceptible current makes its way, the farmer ordinarily owns to the centre of the current (9 Gray, 269): on the other hand, if it be a large natural pond or lake, the line stops at the low-water mark on the shore, and does not extend into the pond; the public having rights in such large bodies of water as are useful for navigation, boating, sailing, and the like (7 Allen, 167).

As to farms bounding on the seashore some peculiar provisions exist in this State.

That strip of land between high and low water mark, generally termed "the flats," is a frequent subject of contention; and the question is often made to whom it belongs, — whether

to the owner of the upland, or to the public. By force of a very early law in Massachusetts (contrary to that of most other seacoast States), if a deed describes the farm as bounding "by the sea," "by the salt water," "bay, harbor, cove, creek, stream, river, or tide-water," it generally includes the whole flats down to low-water mark (if not over a hundred rods), including the exclusive right to gather the seaweed, or other such things washed up thereon by the tide. On the other hand, if the deed bounds "by the shore," "beach, strand, flats, marsh, or cliff," it extends only to high-water mark, and does not give any right to the flats (6 Mass. 435).

While yet again (such are the niceties of the law), if the phrase of the deed is "to the beach *or* sea," "to the *sea*-shore," "to the sea *or* flats," the grantee owns down to low-water mark, flats and all (5 Gray, 328). In view of such nice and subtle distinctions (though founded on better reasons than are apparent) one is tempted to exclaim with the Earl of Warwick, in Shakspeare's Henry VI.: —

> "Between two hawks, which flies the higher pitch;
> Between two dogs, which hath the deeper mouth;
> Between two horses, which doth bear him best;
> Between two girls, which hath the merriest eye:
> I have, perhaps, some shallow spirit of judgment, —
> But in these nice sharp quillets of the law,
> Good faith, I am no wiser than a daw."

WHAT A DEED OF A FARM INCLUDES.

Of course every one knows it conveys all the fences standing on the farm (4 Iowa, 146; 43 N. H. 306); but all might not think it also included the fencing-stuff, posts, rails, &c., which had once been used in the fence, but had been taken down and piled up for future use again in the same place (2 Hill, 142). But new fencing-material just bought, and never attached to the soil, would not pass (16 Ill. 480; 3 Iowa, 220; 2 Scam. 283). So piles of hop-poles stored away, if once used on the land, have been considered a part of it (1 Kernan, 123); but loose boards or scaffold-poles merely laid across the beams of the barn, and never fastened to it, would not be, and the seller of the farm might take them away (1 Lans. 219). Standing trees, of course, also pass as part of the land; so do trees blown or cut down, and still left

in the woods where they fell (54 Me. 309), but not if cut, and corded up for sale; the wood has then become personal property.

If there be any manure in the barnyard, or in a compost-heap on the field, ready for immediate use, the buyer ordinarily, in the absence of any contrary agreement, takes that also as belonging to the farm (13 Gray, 93; 3 N. H. 503; 11 Conn. 525), though it might not be so, if the owner had previously sold it to some other party, and had collected it together in a heap by itself (43 Vt. 95); and even a lessee of a farm could not take away the manure made on the place while he was in occupation (21 Pick. 367; 6 Greenl. 222; 15 Wend. 169). Growing crops also pass by the deed of a farm, unless they are expressly reserved (7 Watts, 378); and, when it is not intended to convey those, it should be so stated in the deed itself: a mere oral agreement to that effect would not be valid in law (19 Pick. 315; 46 Barb. 278; 22 N. H. 538). Another mode is to stipulate that possession is not to be given until some future day, in which case the crops or manure may be removed before that time.

As to the buildings on the farm, though generally mentioned in the deed, it is not absolutely necessary they should be. A deed of land ordinarily carries all the buildings on it belonging to the grantor, whether mentioned or not; and this rule includes the lumber and timber of any old building which has been taken down, or blown down, and been packed away for future use on the farm (41 N. H. 505; 30 Penn. St. 185).

But if there be any temporary buildings on the farm built by some third person, with the farmer's consent that they should belong to the builder, the deed would not convey these, since such buildings are personal property, and do not belong to the land-owner to convey. The real owner thereof might move them off, although the purchaser of the farm supposed he was buying and paying for all the buildings on it (38 N. H. 429; 19 Conn. 154). His only remedy in such case would be against the party selling the premises. As part of the buildings conveyed, of course the window-blinds are included, even if they be at the time taken off and carried to a painter's shop to be painted: it would be otherwise if they had been newly purchased and brought into the

house, but not yet attached or fitted to it (40 Vt. 233). Lightning-rods also go with the house, if a New-England farmer is foolish enough to be overcome by those smooth-tongued lightning-rod agents!

A furnace in the cellar, brick or portable (4 E. D. Smith, 275; 75 Ill. 385; 39 Conn. 362), is considered a part of the house; but an ordinary stove with a loose pipe running into the chimney is not (24 Wend. 191), while a range or grate set in brick-work is (7 Mass. 432; 33 N. H. 104; 2 B. & C. 76). Mantel-pieces so attached to the chimney as not to be removed without marring the plastering go with the house; but, if merely resting on brackets, they may be taken away by the former owner without legal liability (102 Mass. 517). It is not yet fully settled in Massachusetts, whether a deed of a house includes the gas-fixtures therein or not, though it is generally understood, that, if a lessee puts in his own gas-fixtures, he may remove them when his lease expires (108 Mass. 193; 1 Duer, 363). The pumps, sinks, &c., fastened to the building, are a part of it in law (99 Mass. 457), and so are the water-pipes connected therewith, bringing water from a distant spring (97 Mass. 133). If the farmer has iron kettles set in brick-work near his barn for cooking food for his stock, or other similar uses, the deed of his farm covers them also (19 Pick. 314), as likewise a bell attached to his barn to call his men to dinner (102 Mass. 514; 36 Conn. 86). A cider-mill goes with the apple-orchard, and not with last year's crop of apples (41 N. H. 504). If he has a cattle-barn on the premises, the tie-up planks, stanchion-timbers, tie-chains, and hinge-hooks used for fastening the animals in their stalls, belong to the barn, and not to the cattle (41 N. H. 513). If the farmer indulges in ornamental statues, vases, &c., permanently erected, and resting on the ground by their own weight merely, and sells his estate without reservation, these things go with the land (12 N. Y. 170). But even this might not be so, if the article had just arrived, and never been placed or fitted to its position on the lawn (17 N. H. 282).

HIRING HELP.

After taking possession of the farm, one of the first, and often one of the most trying duties of the farmer is to hire his help. Every employer of labor knows full well, that if a

man is hired without any special bargain as to the price, he is entitled to the current rate of wages for such labor, and no more; but every laborer may not be aware that if he engages to work for a year, but leaves without good cause at the end of eleven months, he is not legally entitled to any compensation for what he has done, but forfeits the whole: and this is so, whether he has agreed to stay for the entire year at one round sum or for twenty dollars a month (12 Met. 286); although, if the farmer had paid for each month's work as it came due, he could not probably recover it back, even if the laborer afterwards wrongfully left him before his time was out (17 Vt. 355; 1 Cush. 279). And, if he has given a note for the amount already earned, he must pay the note, notwithstanding the subsequent failure of the other party to work out his full time (13 Johns. 53). But if nothing has been paid, and no note given, the laborer would not only forfeit his wages, but also would be liable to pay the employer for any damage done him by leaving him without help at a critical time in the year: therefore, if he has agreed to work a year for twenty dollars a month, and quits just before haying because he can get forty dollars at mowing for some one else, and the farmer has to pay that price to get another man to supply his place, he can recover of the laborer the extra twenty dollars a month for the balance of the unexpired engagement, as damages caused him by such breaking of the contract; and the laborer could not set off against the claim of the employer the value of the work he had really done and not been paid for (4 Wend. 605). And this is so, whatever specific thing you hire a man to do. If he engages to build you a barn for five hundred dollars, to lay up a hundred feet of stone wall for a dollar a foot, or dig a well twenty feet deep for twenty-five dollars, and voluntarily quits without good excuse when the job is half done, you are not obliged to pay a single cent for what he did do (2 Mass. 147; 11 Gray, 396); although, if he had substantially completed it in good faith, he would not lose all his labor because, in some minute particulars, he had not finished it exactly according to the precise terms of the contract (7 Pick. 181; 9 Allen, 355).

On the other hand, if the laborer has good cause for leaving, he may do so, and compel the employer to pay for the

time he actually did work. And among the well-known excuses for leaving before the original bargain contemplated, are sickness of the hired man, or his physical inability to labor (11 Met. 440), or the prevalence of some dangerous epidemic in the family or in the vicinity, which might render it hazardous for the man to remain; such as cholera, small-pox, and the like (43 Me. 463). Any improper treatment by the employer, as scarcity of suitable food, is also deemed sufficient excuse for seeking other quarters.

And even though the laborer so misbehaves himself that he is arrested and imprisoned for some crime, and so is busy picking oakum for the county in the house of correction, this is considered a legal excuse for not attending to his farm duties, and he can make the farmer pay for what he did do before he went into the public service (11 Allen, 201).

It has been thought that merely harsh language by the employer to his employee would not justify him in leaving before his stipulated time was out (27 Vt. 645). In one instance the farmer asked his hired man to water and feed the cattle one Sunday morning. The man said he wouldn't do it: the employer told him to "go to hell, but to mind and work his time out first." Instead of following the directions, the laborer went to a lawyer's office, and sued for his wages up to that time, but was held not entitled to any thing (1 Wend. 515). Had the master required him to do any unnecessary or unlawful work on a Sunday, it would probably be a good excuse for his leaving (8 Conn. 14; 1 Browne, 29); but necessary farm-work, such as care of live animals, may undoubtedly be required on Sunday (16 Jur. 549; 6 Dunl. 1256). But inasmuch as it is always a question for the jury to decide whether the man had good cause for leaving (14 Gray, 454), their sympathies are very apt to be with the employed, and they usually think the laborer is worthy of his hire. The cheaper way generally in such cases is, if the amount is not large, to pay the man, let him go, and never hire him again.

What we have before stated about a forfeiture of wages is founded upon the doctrine that the laborer has made an entire contract, and that he must faithfully fulfil it, or he is entitled to no pay: therefore, if for any reason this entire contract is not valid and binding on the laborer, he

may disregard it entirely, and quit when he likes, and still recover for all the time he did work. For this reason, if the bargain is to work for *more* than one year, or even for just a year, but to commence at some *future* day, as a week after making the bargain, and the contract is not written down and signed (which nobody ever thinks of doing), it is not binding on the laborer, and he can break it from a mere whim, and still make the farmer pay (5 Gray, 41). In like manner, if the laborer is under twenty-one, he is not bound by his bargain, but may desert when he pleases (2 Pick. 332; 19 Pick. 572), and recover "back-pay." And this is so, although the young man appears to be of age, or is married and has a family (37 Vt. 647; 41 N. H. 346), or even though he falsely stated he was over age, and able and willing to make as good a bargain as if half a century old (11 Cush. 40; 10 N. H. 184).

But even if you have a nominal remedy against a laborer who has left you unjustifiably in the midst of his contract, this so often proves practically worthless, that the law also gives you a right of redress against the person who has enticed him away with the offer of better wages, or otherwise. The law does not allow one man thus to interfere with another man's business without being liable to pay for all the inconvenience and loss he may thereby cause to the person whose men are thus induced to break their contract with their former employer (107 Mass. 555; 56 N. H. 456).

It is for this reason that combinations among workmen for a strike, and to induce fellow-workmen, by intimidation or otherwise, to forsake their employers, are clearly illegal, and render the parties involved liable both civilly and criminally. Such associations are more common among operatives than farm-laborers; but I suppose the same rules apply to both.

RIGHTS IN THE ROAD.

If a farm deed is bounded by, on, or upon a road, it usually extends to the middle of the roadway. There are a few exceptional cases; but ordinarily the farmer owns the soil of half the road, and may use the grass, trees, stones, gravel, sand, or any thing of value to him, either on the land, or beneath the surface, subject only to the superior rights of the public to travel over the road, and that of the highway

surveyor to use such materials for the repair of the road; and these materials he may cart away, and use elsewhere on the road, but he has no right to use them for his own private purposes (1 N. H. 16). No other man has a right to feed his cattle there, or cut the grass (44 Vt. 49) or trees; much less deposit his wood, old carts, wagons, or other things thereon (8 Met. 576; 8 Allen, 473; 1 Penn. St., 336); and, after notice to the owner, you may remove them to some suitable place, and if they are lost or injured it is not your fault (12 Met. 53). The owner of a drove of cattle which stop to feed in front of your land, or of a drove of pigs which root up the soil, is responsible to you at law as much as if they did the same things inside the fence. Nobody's children have a right to pick up the apples under your trees, although the same stand wholly outside of the fence. No private person has a right to cut or lop off the limbs of your trees in order to move his old barn or other buildings along the highway (4 Cush. 437; 97 Mass. 472); and, even if the owner of the building has a license to move the same through the streets, this does not exempt him from liability to private sufferers. And no traveller can hitch his horse to your trees in the sidewalk, without being liable, if he gnaws the bark or otherwise injures them; and you may untie the horse, and remove him to some safe place (54 Me. 460). If your well stands partly on your land, and partly outside the fence, no neighbor can use it, except by your permission. Nay, more: no man has a right to stand in front of your land, and whittle or deface your fence, throw stones at your dog, or insult you with abusive language, without being liable to you for trespassing on your land (11 Barb. 390); he has a right to pass and repass in an orderly and becoming manner, — a right to use the road, but not to *abuse* it. Perhaps it may be well to state here, that, if the highway becomes suddenly impassable by heavy snows or deep gullies, he may turn aside into your adjoining land, without being liable as a trespasser, if he does no unnecessary injury (7 Cush. 408). But, notwithstanding the farmer owns the soil of the road, even *he* cannot use it for any purpose which interferes with the use of it by the public for travel. He cannot put his pig-pen, wagons, wood, or other things there, if the highway surveyor orders them away as obstructing

public travel. If he leaves such things outside his fence, and within the limits of the highway as actually laid out (though some distance from the travelled path), and a traveller runs into them in the night, and is injured, the owner is not only liable to him for private damages (15 Conn. 225), but may also be indicted and fined for obstructing a public way. And, if he have a fence or wall along the highway, he must place it all on his own land, and not half on the road, as in case of division fences between neighbors (4 Gray, 215). But, as he owns the soil, if the road is discontinued, or located elsewhere, the land reverts to him, and he may enclose it to the centre, and use it as a part of his farm.

WAYS OVER THE FARM.

Others may acquire a right of way over your farm in either one of three modes: 1st, By purchase or grant from you; 2d, By long-continued use, or prescription; 3d, By actual necessity. As to the first method, to gain a permanent right by purchase or grant, it must have been by a regular and complete deed, executed in the same way as a deed of the land itself. If the bargain was only oral, or if it was even in some simple written paper, but not in a formal deed under seal, it would, even though fully paid for, be in law revocable, — a mere license as it is called, — and might be terminated, at the mere wish of the land-owner, by a notice to the other party to use it no longer. Being a kind of interest in land, the strict law requires it to be conveyed by a deed (2 Gray, 302; 2 Allen, 578).

2d, The second mode, by prescription, requires length of time, — twenty years at least; and the way must have been used continuously, peaceably, and under a claim of right to do so, and not by your permission or consent. If it was only very rarely used, if it was not peaceably used, but against your protest, or if used by your tacit consent, the use would not ripen into a legal right, however long continued (8 Gray, 441; 11 Gray, 148). And, if used under all those conditions, it must have been in some regular and uniform place. No man can gain a right by such means to wander over your farm just where he has a mind to or where his convenience suits him. That would be an intolerable burden to the farmer (5 Pick. 485).

To gain this right by twenty years' use, it is not necessary that any one owner should have travelled it twenty years. If successive owners have unitedly used it for that period, it would be sufficient, so far as length of time is concerned (2 Allen, 277). And if this prescriptive right of way was gained only by using it for some *particular purpose*, as for carting wood from a wood-lot beyond, that would not authorize the person to continue to use it for all purposes, after the wood had been all cut off, and it had been covered over with buildings (11 Gray, 150; 15 Gray, 387).

3d, The third mode, by necessity, arises when you sell a man a back lot, with no means for him to get to any highway except over your remaining land. The law gives him a right to cross your land to and fro: otherwise his land would be useless. At present he can't reach it by balloon to any practicable purpose, and therefore he must cross your land. So, if you sell a man all your front land, retaining the back part, and have no way out except over the part sold, you retain a right to cross the lot sold, though your deed in such case says nothing about it; and this is so, even if in your deed you warrant the land to be *free and clear from all incumbrances* (4 Gray, 297). It is a familiar maxim that "necessity knows no law."

But this right of way by necessity continues only so long as the necessity itself continues; and if a *highway* is afterwards laid out touching the back land on the other side, or if the owner afterwards buys a lot adjoining it and between it and a highway, he can no longer cross over your land as before, but must go out the other way (14 Gray, 126). And, so long as he does have such a right, he must go in such place as you designate, if it be a reasonable place. If you mark out a road or a way along the fence, or on the poorer ground, he should confine himself to that (2 Pick. 478). And, if the way becomes miry or out of repair, he must keep it in good condition if he wants to use it. Your duty is done when you allow him to cross: you are not obliged to smooth his pathway for him, and rake out the sticks and stones (12 Mass. 69). But if you actually obstruct his usual road, or if it becomes suddenly impassable by natural causes, he would have a right to deviate to one side until he has opportunity to remove the obstructions (2 Allen, 546).

All such rights of way are apt to be nuisances to the farmer, and not unfrequently lead to litigation.

It is important to know, that, in whatever mode a right of way is acquired over your land, you have ordinarily a right, in the absence of any stipulation to the contrary, to erect suitable gates or bars at the entrances thereto from the highway; and if the other party leave them open, and cattle get in, or yours get out, he is liable to you for the damage which ensues (9 B. Monr. 21; 22 Iowa, 161; 44 N. H. 539; 45 Md. 357).

AS TO FARM FENCES.

It was a fundamental principle of our law (contrary to that of many of the United States), that every man must keep his cattle on his own land at his peril. He was liable if they strayed away into other people's grounds. It was necessary, therefore, at common law, that every man should keep a personal watch over his animals, or surround his land with a fence. This fence was primarily, therefore, not to keep other people's cattle out, but to keep his own in: and so any land-owner, if he kept cattle, was bound to erect the entire fence around his close, whether his neighbor kept any cattle or not; and, if the latter also owned any, he must do the same, or keep his beasts at home in some other way.

But two parallel fences would be attended with useless expense; and, as one and the same fence would answer for two adjoining proprietors, it was long ago provided by statute law that adjoining owners of improved lands should maintain partition fences in equal shares; and, if they did not agree how the fence should be divided, either might apply to the fence-viewers, elected by the town every year, to decide which part each proprietor should keep up. And if, after such decision, either party refused or neglected to build or keep in repair his portion, the other could do so, and recover the expenses of the delinquent owner by a suit at law. It follows, therefore, that if my adjoining owner does not keep up his half of the fence, and my cattle get through and injure his crops, he has no redress against me, since his own neglect was, in part at least, the cause of his injury. But now comes in a very important addition to this rule; and this is, if my cattle stray beyond the immediately adjoining land, into the farm of a third person, and there injure his

crops, I am liable for the damage to him, although my own half of my fence is good, and my animals escaped through my immediate neighbor's defective fence: because, as to all persons except my nearest neighbor, I am still bound to keep my cattle on my own land; and it is no excuse for me, so far as third persons are concerned, that my neighbor neglected his half of our division fence. Whether my neighbor would be liable to refund to me what I had to pay to such distant owner is not yet settled; but it is established that the latter could not himself sue the negligent landowner, but only the owner of the cattle (11 Gray, 489). Nay, so far is this rule carried, that although such third person did not keep up his own fence, and the cattle go into his land through his own fault, he can still make me pay the damages; because he is not bound in law to keep up any fence at all, except as against his nearest neighbor, and not against my cattle farther off. In other words, if A., B., and C. own three adjoining lots, and A.'s cattle stray into B.'s land through B.'s neglect, he has no remedy against A.; but if they stray still farther, on to the land of C. also, and there do mischief, C. has a claim for the damages against A., even though the animals went through his own broken-down fence. A. must keep his animals at home at his own peril.

For similar reasons, if A. turns his cattle into the highway, and they come on to your land from the road, either because your front fence is defective or altogether gone, you have a remedy against A. for all the damages you sustain; for you are not obliged to have any fence on the road, except to keep your own cattle in, and A. must keep his own cattle at home. And so stringent is this rule, that if other people in roaming over your grounds, hunting, fishing, or berrying, leave your bars down, by which your cattle escape into the highway, and thence come into my cornfield, you are responsible to me for all the damage, although not actually in fault, if you kept all your fences up (30 N. H. 143). On the other hand, if you are carefully driving your cattle along the highway, and without your fault they break away from your control, and run into my adjoining land, and you drive them out as soon as you reasonably can, you are not responsible for the damage done; for you had a right to drive them along the highway, with proper care and attention (114

Mass. 466; 13 Me. 250); while in the other case they were not lawfully in the highway at all, although the owner was not personally at fault.

The proper legal height of all division fences in this State is four feet; and they may be made of rails, timber, boards, or a stone wall. A brook, river, pond, ditch, or hedge may also be sufficient, or any other things which the fence-viewers consider equivalent to a four-foot rail-fence. The number of rails is not prescribed by law.

These division fences may be placed one-half on each side of the line, even though ditches be used three feet wide (2 Met. 180); and both owners have a common interest in the whole fence; and they must be kept in good repair throughout the entire year, unless both parties otherwise agree. But the duty of maintaining partition fences by statute exists only when both parties *improve* their lands. It would not be just to make a man whose lands are wild, or not improved, and on which he neither has cattle to stray away and injure others, or growing crops which can be injured by other people's animals, to pay the expense of building or maintaining a fence which can be of no advantage to him. Accordingly, if only one of the adjoining owners improves his land, he has no right to compel the other to pay any part of the expense of a fence; and if he needs a fence to keep his own animals at home, or for any other purpose, he must build it himself. If, therefore, A. owns a pasture-lot alongside of B.'s wood-lot, the latter is not bound by statute to help maintain a fence between them; but, if A. puts cattle into his pasture, he must keep them there as best he can, either by watching them, or, if he thinks it cheaper, by building a fence himself around his entire lot. So, if both are wood-lots, the owners are not obliged to erect a fence; but, if either allows his cattle to range the woods, he must take care they do not browse through his neighbor's woods, or he will be responsible.

The sum of the whole matter is this: by the common and general law every man is bound to keep his own cattle on his own land at his peril. The duty of doing this *by a fence* is created wholly by a statute of the Commonwealth, and a fence need not be made except where the statute clearly requires it.

What we have thus far said as to the joint expense of

fences relates only to *partition fences* between two farmers. As to fences along a railroad, the law is quite different. The general railroad law requires the company to maintain a suitable fence along the whole line, through woodland as well as improved land; and the farmer has no part of the expense to pay. This railroad fence need not be always four feet high, nor need it always be so close as the division fence between land-owners (98 Mass. 560). It must be "suitable" merely,—suitable for the place where it is situated; and through the woods, or where there is little or no danger of animals straying on to the track, it might be quite light, and yet comply with the law. But if any cattle of the adjoining land-owner do escape through it on to the track through its unsuitableness, and are there injured by a passing train, the company is responsible (1 Allen, 16). But here, again, the same principle comes in which we have before stated; viz., the company is not bound to fence out everybody's cattle, but only those of the land-owner immediately adjoining. If, therefore, the animals of one remote from the railroad break out or stray away from their pasture, and after wandering over the intermediate lands finally find their way on to the railroad, and there meet their death, the railroad company is not absolutely liable: the owner should have kept his cattle on his own lot, and not allowed them to trespass on others' lands (98 Mass. 560). Of course, if they were lawfully pasturing on the lands near the railroad, by permission of the land-owner, they would be protected in the same manner as his own animals are; but if, unlawfully straying in the highway, they are killed while crossing a railroad, the company is not bound to pay, unless guilty of actual negligence.

IMPOUNDING CATTLE.

Closely connected with the subject of fences is that of impounding animals. If you find your neighbor's cattle in your cornfield, there are three courses you may pursue: 1st, You may put the animals in the town pound; 2d, You may sue the owner for damages; or, 3d, You may quietly turn them into the highway and say nothing. Of these three the last is the easiest to be done, and the hardest to make up one's mind to do. We are directed in the good book to forgive our neighbor his trespasses; but it says nothing about

forgiving his cattle their trespasses. If a man ever allows himself to violate the third commandment, he is tempted to use that outlet for his indignation when he jumps up from the dinner-table in a hot day in July to drive his neighbor's breachy cattle for the seventh time out of his garden or corn-field. It might, perhaps, alleviate his sufferings to know, that, if they then stray away and are lost, it is not his fault, and the owner has no claim on him (18 Pick. 227; 6 N. H., 213; 10 Vt. 71; 32 Penn. St. 58, 65); and he may even mildly hasten their departing steps by the aid of a good-sized dog (23 Vt. 236; 9 Mich. 158; 18 Vt. 425); and if the dog, in the excitement of the moment, takes a bit out of the nose or ear of the trespassing cattle, its owner is not bound to supply another.

The second remedy of a suit at law is more peaceful, but slower, and more likely to benefit the lawyer than the farmer. Impounding is the most summary, and generally the most effective, but is surrounded with legal dangers; and a slight mistake is often fatal, and, like

> "Some muskets aimed at duck or plover,
> Bear wide, and kick their owners over."

The general outline of this remedy is this. If any person actually finds any sheep, swine, horses, or neat-cattle doing damage in his land, he may drive them to the town pound, or some other suitable place, giving them sufficient food and water; or he may shut them up in his own yard for a reasonable time before driving to the pound, and in the mean time send a memorandum to the owner of the animals, stating the cause of impounding them, the amount of damage done by them, the charges for feeding, &c., in order that the owner may come and pay the damages, and take away the beasts. If he does not come, or if the party impounding prefers, he may, in the first instance, drive them to the pound, or send for a field-driver (who is generally the last married man in town), and request him to impound them, sending a similar memorandum to the pound-keeper, and also a written notice of the fact to the owner of the animals, within twenty-four hours, containing a description of the beasts, and a statement of the time, place, and cause of impounding. Before the owner can release his animals, he must pay the damages and

all the expenses; and, if he decline to do so, they may be sold by public auction, and the balance of the proceeds above the expenses deposited with the town treasurer for the benefit of the owner. This remedy seems to be seldom resorted to in modern days; for, in most of the town pounds which we pass, we notice that the gate is entirely gone, or so dilapidated as to furnish very little security against the escape of animals confined therein: nevertheless every town is still liable to a fine of fifty dollars for not keeping one or more suitable pounds.

A recent law of this Commonwealth has added one more very important protection against invading animals, making the owner of any sheep, cattle, horses, swine, *or fowls*, liable to a fine of ten dollars if he wilfully allows them to enter another's orchard, garden, mowing-land, or other improved land, after receiving written notice from the owner forbidding it (St. 1878, c. 168). This statute extends to fowls, which the laws in regard to impounding did not.

FARMER'S LIABILITY FOR HIS ANIMALS.

Passing from the subject of cattle straying away, and doing damage on other people's grounds, we have next to consider how far the farmer is liable for their good behavior in the public streets, or even on his own premises. It is clear enough, that if a vicious horse by the city sidewalk suddenly nips a piece out of your coat-sleeve as you are passing by, and his owner knew his habits, he is bound to pay the tailor's bill; whereas if he only frightens you, and makes you jump, you have no redress, for that is what the law calls *damnum absque injuria*. That is an innocent expression in itself; but, if you give an excited utterance to it, a bystander might think you were indulging in forbidden language!

It may not be generally understood that if a man turns his animals loose into the public highway, and they there injure the person or property of another lawfully using the way, the owner is responsible for all damages they may do, whether he knew they had any dangerous disposition or not (4 Allen, 444; 39 N.Y. 400). He had no right to let his cattle run loose in the public highway. In one instance a man let his horse go out to feed in a public place where some very young children were playing, and some of them began to

switch him, whereupon he turned and kicked one of them so that he died, and the owner was convicted of manslaughter (10 Cox, 102). Had he known the animal was dangerous, it might have even been more serious with him, since, in the Mosaic law, it was declared that if the owner of an ox knew that it pushed with his horn, and did not keep it in, and it killed a man or woman, not only the ox, but also the owner, was put to death (Exod. xxi. 29).

And now as to his liability for animals on his own premises. Every owner of a dangerous or vicious animal known to be such is liable for all injury he may do to another, even though the latter is at the time trespassing on the former's premises (27 Conn. 404; 124 Mass. 49; 3 E. D. Smith, 574). If, therefore, a man, while hunting through your woods on Sunday, is attacked and bitten by your savage dog, you must pay for the pound of flesh, although you did not set him on (17 Wend. 497). You should have posted up an advertisement from St. Paul, — BEWARE OF DOGS. And in like manner, if a boy, while robbing an orchard, is tossed by a vicious bull into the boughs of the apple-tree overhead, the owner is as much liable in law to pay for the boy's torn trousers as if he had received the same salutation when boldly coming up the path in broad daylight to call on the farmer's youngest daughter. In one instance a farmer, who was much annoyed by strolling fishermen, put a savage bull into the lot along the stream. On his neighbors remonstrating with him that he ought to give them notice what kind of animal it was, he remarked, "the fellow would give them notice enough himself;" but, as his notice was rather too brief, the farmer had to pay five hundred dollars for two broken ribs (3 C. & P. 138). But this extreme and severe liability absolutely depends upon the fact whether the owner of the animal had any previous knowledge of the brute's warlike disposition. If so, the mere keeping of such an animal unconfined is itself, in law, deemed culpable negligence. If he did not know the fact, some other form of negligence is essential in order to make an owner of an animal liable for his conduct while on the owner's premises, or while lawfully in the highway under the care of a keeper. For this reason, if a man's horse runs away in the street, and injures some one, or breaks a carriage, the owner is not liable, unless he

carelessly left him unhitched, or was guilty of some other negligence (3 Allen, 565; 24 La. Ann. 390). The not uncommon opinion to the contrary is quite erroneous.

DOGS.

The question of liability for and protection against dogs has been a perplexing one from earliest times. The laws of Solon — undoubtedly the wisest law-giver of his age — declared, that, if any dog bit a person, he should be delivered up, and bound to a log of wood four cubits long; and the Romans also adopted the same law in their "Twelve Tables;" while an early law in Wales provided, that, after a dog had bitten three persons, he should be first tied to his master's leg, and then killed.

Owing to the naturally wild and fierce disposition of dogs, it has not been generally thought necessary by legislators, in order to make the owner liable, to prove that he actually knew the dog was accustomed to bite, as it is in the case of other domestic animals. The law presumes that the son of every Puritan farmer in Massachusetts has been brought up from boyhood to repeat those lines of good old Dr. Watts: —

> "Let dogs delight to bark and bite,
> For 'tis their nature to."

Accordingly the owner is liable, if they do, whether his education on this point has been neglected or not (3 Allen, 191). And not only so, he must with us pay double damages for the pleasure of keeping such animals; and, after actual notice of his disposition, the damages may be increased to threefold. And so comprehensive is this law, that if your dog rushes out into the street, and in mere play jumps at a horse's head, whereby he is frightened and runs away, breaking the carriage, and perhaps the limbs of the occupants, you are responsible for double the amount of the entire damage, though it amount to several thousand dollars; for the liability of the owner is not limited to damages from the *bite* of a dog, but extends to any direct injury, however caused (1 Allen, 191). Again: if your dog is at large, although he is a good-natured Newfoundland, and, being teased and irritated by young children at play, turns upon them, and bites one severely, you may be liable to heavy damages, although

the dog was never known to bite before (4 Allen, 431); and this is so, although the dog is duly licensed and collared. The object of the dog-tax was not to exempt the owner of a dog, when known, from his former liability for all his dog's mischief, but to provide a fund for the remuneration of the farmer, when the owner was not known or was not pecuniarily responsible. Accordingly any man whose animals are injured by a dog may now have either mode of redress, — he may file his claim with the selectmen, and take simply the amount of damages he may have sustained; or he may go for the owner of the dog, and get double damages, if he can: but he cannot try both methods. If he is paid his simple damage out of the dog-tax, the county may compel the owner of the guilty dog to refund the amount paid out. If he is injured in his own person, his only remedy for remuneration is against the owner of the dog. The "dog-law" does not include injuries to man, but only to his domestic animals. Perhaps it should be extended in this respect.

But no man is obliged to wait until the mischief is done, and then seek redress by the law's delay. You may take the law into your own hands, and kill any dog, licensed or not, that suddenly assaults you while peaceably walking or riding in the public streets; and so you may if the dog is found out of the enclosure or care of the owner, wounding, worrying, or killing any neat-cattle, sheep or lambs.

If a dog is not licensed, your right to kill him is much broader. The law says you may kill him "whenever or wherever found." These are its exact words. But if you think this authorizes you to kill him on his owner's premises, and you should pursue him into his owner's house and there kill him, contrary to his master's wishes, you might find out your mistake by being compelled to pay, not only the full value of the dog, but also for unlawfully entering the owner's premises (11 Allen, 151; 109 Mass. 276). "Whenever and wherever found," therefore, don't mean exactly what it says. Such are the quirks of the law. Some people call it a sort of "hocus-pocus science;" though *I* don't.

Again: do not think, that, because you can openly and publicly shoot an unlicensed dog which is hanging around your premises annoying your family, you can therefore poison him; for that kind of physic is not to be thrown even to dogs, and

the mere exposing of any poison for that purpose, whether the dog touches it or not, may cost you fifty dollars and the costs of prosecution. And this is very moderate, considering, that, for the malicious poisoning of some other domestic animals, — even a sucking calf, — you may obtain a free residence in that splendid new State building at Concord for *five years*, — that is, unless you see fit to break out before that time! Thus much for the law of dogs. And the only crumb of consolation I can offer on this subject is this: if two dogs, yours and your neighbor's, go off on a joint raid on a flock of sheep, you are bound to pay only for those your dog killed, and not the others, if anybody can find out which was which (20 Pick. 477; 20 Barb. 479); whereas, if the two owners of the dogs go out together to rob a melon-patch, one is liable for all the melons carried away, although the other ate them all (10 Wend. 654; 1 Stark. 352); so that in one respect the law seems to favor the dogs. On the other hand, as a man is not liable for any sheep, fowls, or other things which his mischievous boys wantonly kill when coming home from an unsuccessful hunt, in this respect again the law is rather against the dogs.

LIABILITY FOR HIS MEN.

The liability of a farmer who employs many hands may prove extremely onerous at times. As a general rule, he is liable for all the injury they do while actually employed in his business: therefore if you send a boy to burn old brush, and the lad leaves his work to look after his partridge-snares or rabbit-boxes in the wood, and the fire runs into the next field, and consumes the crops or fence of your neighbor, you must pay the bill, although you told him to watch it carefully, and never leave it a minute (5 Gilm. 500; 7 Cush. 385). If you send a load of farm-produce into town, and the driver falls into a doze and runs into another team, you must pay for the broken spokes. If your man, in going to or from the hayfield, carelessly swings his scythe, and cuts an ugly gash in the leg of a passer-by, you had better pay the doctor's bill, and be glad to get off thus easy. If, in cutting your wood, a man accidentally cuts over the line, on your neighbor's lot, you are responsible, although you told him where the line was (23 Mich. 298). And though your man

shows a touch of maliciousness in his act done in the prosecution of your business, and intentionally runs into another team which somewhat obstructs his way while driving your load, you may not screen yourself behind his unnecessary and wilful violation of your orders (12 Allen, 49; 114 Mass. 518; 109 Mass. 154). Of course, in all these cases, you could compel the servant to repay you all the expenses he had thus caused you by his misconduct (63 Me. 177; 43 Conn. 244). On the other hand, to make you responsible for his carelessness, he must have been *at the very time* on your business. If he borrows your horse and wagon, and goes off on pleasure, or business of his own, and runs over somebody, you are not responsible, merely because it was your horse and wagon (26 Penn. St. 482); much less would the master be liable if the servant took his team without his knowledge on pleasure or business of his own (4 Daly, 338).

How it would be if the fellow was on his own business and yours too, is a nice question, which might puzzle even a "Philadelphia lawyer." In one instance a farmer lent his man his team to go to town for a holiday, and asked him to stop at the butcher's on his way home, and bring along a piece of meat for next day's dinner. While fulfilling this order, the man also took a little "fire-water," and soon after ran over an old woman in the public highway; but the master was considered not responsible. This was, however, in the courts of the Emerald Isle (9 Irish L. R. 557).

One more distinction on this subject it may be well for you to know; and that is, that, although an employer is responsible for any careless injury his men may do to third persons, he is not responsible for such an injury to other fellow-workmen. If his man, therefore, by the very same act of negligence, injures a co-laborer and also a bystander, the latter would have redress against the master, and the other not; for, by a species of rather artificial reasoning I think, a man, when hiring out, is supposed in law to have anticipated any direct injury from the carelessness of his co-laborers, and taken the risk on himself (but not to his wife, 112 Mass. 234), whatever his rate of wages. But, on the other hand, he is not presumed to have contemplated any negligence on the part of his *employer;* and therefore he has a remedy against the latter for his own personal care-

lessness, or in providing dangerous or insufficient machinery or apparatus, or even in hiring notoriously incompetent or habitually careless men. In one instance an employer was compelled to pay two hundred dollars to his hired man, who fell into a barrel of hot water, set in the ground and carelessly left uncovered, but which the man did not know of (111 Mass. 322). And this last rule would probably render the employer liable for any injury to his servants from dangerous or vicious animals intrusted to them to take care of; at least, if the owner knew of their character, and the man did not. But this whole subject is surrounded with subtle distinctions; and my best advice to you is, that, if you ever have such a case, you do not rely upon this lecture, nor upon any of those books called "Every Man his own Lawyer," but go and get the best legal counsel you can find.

ABOUT FIRES.

If a careless hunter fires your woods, and, much to his consternation, the flames spread to your fields, and run along the fences to your barn, he is responsible for the whole loss, although he did his best to stay its progress. A man who wrongfully sets in operation a dangerous instrument must take all the consequences directly caused thereby (21 Pick. 378; 43 Cal. 437; 2 Harr. 443); and this would be so, whether the fire ran along the ground continually, or whether the sparks were blown through the air a considerable distance, and then set fire to some person's property (107 Mass. 494).

But as any farmer has a legal right to burn the brush, old stumps, &c., on his own land, if he does so at proper times and in a proper manner, he is not responsible, if, by a sudden rise of wind or other cause, without negligence on his part, the fire is accidentally communicated to a neighbor's premises, and causes him serious injury. The *gist* of his liability in such cases is some carelessness, either in the time of setting the fire, or the manner of doing so, or in watching it afterwards; and the man who suffers is bound to make it clear that the other was to blame (54 Me. 259; 22 Barb. 619; 44 Barb. 424; 18 Me. 32; 11 Met. 460). But even your negligence will not always render you liable for the spread of a fire, unless it was originally kindled by you intentionally.

Therefore, if your barn takes fire through your carelessness with the lantern, or that of your man with his pipe, and thereby your neighbor's property is also consumed, you are not bound to pay for it: the law seems to consider that you have suffered enough for your conduct in the loss of your own property (1 Bl. Com. 431; 37 Barb. 15; 35 N.Y. 210; 62 Penn. St. 353).

Still less would you be responsible if the fire originated from causes beyond your control. If your barn is struck by lightning, or your haystack ignites by spontaneous combustion, without any fault on your part, and the flames spread to the adjoining owner's property, it would be hard indeed if you had not only to lose your own, but to pay for his also (8 Johns. 422; 11 Q. B. 347). And I suppose, even if you were careless in not promptly and energetically putting it out when you could have done so, and it spreads beyond your control, this would not render you liable, as perhaps it might have done had you purposely set fire to your brush-heap or stubble.

As to railroad fires the law is somewhat different from that relating to individuals. Formerly, and antecedently to any statutes, railroad companies were not liable for fires caused by their locomotives, without proof of some negligence, either in the construction or mode of running the engine by which the fire was caused, or otherwise (5 H. & N. 674; 18 Barb. 80; 30 Iowa, 420; 15 Conn. 124; 37 Me. 93): but as the liability to such fires was so great, and the amount of damage so caused was very extensive, it became necessary to enlarge their liability; and now in this State, by Gen. Stat., chap. 63, § 101, railroad corporations are liable for all damages to the buildings or personal property of land-owners along their route, arising from fire communicated by their locomotives, and without any proof of negligence or carelessness, either in the company or any of its employees.

And this statute has a very liberal construction, extending not only to buildings immediately adjoining the railroad, and which are fired *directly* by sparks from the locomotives, but also to buildings at a long distance from the road, and which are set on fire by sparks flying through the air from some building nearer by, which had first taken fire from the engines (13 Met. 99; 98 Mass. 414; 103 Mass. 586).

As a protection to themselves, however, railroad companies are authorized to get the property along the route insured for their benefit; so that, if obliged to pay, they may remunerate themselves, and thus the burden is more equally divided. Different States may have different statutes upon this subject.

WATER RIGHTS AND DRAINAGE.

Water is flowing and fleeting, and the rights of farmers therein are much of the same kind. If a stream of water flows through a farm, the owner has a right to use any reasonable quantity of it as it flows along, for watering his stock, irrigating his land, or supplying his house for domestic use. But he must not monopolize the whole: his neighbor's cattle must have water also. He may, to some extent, change the course and flow of the brook on his own land, provided he turns it back into the natural channel before it reaches the land below him. He has no right to conduct it into his neighbor's land, without his consent, at a different point or place than where it naturally entered therein. He may build fish-ponds, or otherwise dam up the stream, provided he does not thereby flow back on the land above him. If he does so, he is liable to a suit for trespass, and finally, if he continues it, to an injunction. A farmer acquires no right to flow another's land without his consent, as a mill-owner has; for the statutes giving such right upon payment of a fair compensation, apply only to mill-dams, cranberry-dams, and the like: and, if your neighbor below you does so dam up the stream as to flow back on you, you may enter on his land, and take down enough of the obstruction to relieve your land of the overflow.

So, if a natural stream becomes obstructed by leaves, sticks, and rubbish, you have a right to go on to the land and remove the obstructions, so that the water will flow as freely as before (5 Met. 429); and the natural deposits you may place on the banks of the stream (21 Pick. 341). The same rules prevail as to artificial water-courses or ditches, provided you have acquired a right to have a ditch running through another's lands. But you have not ordinarily such a right, unless you or your predecessors have purchased the privilege of him, or have enjoyed it so long and under such circumstances as to have thereby gained a *prescriptive right* as it is

called, or, lastly, have had the ditch opened by commissioners appointed by the court under General Statutes, chap. 148.

The rights and liabilities of farmers in *surface-water* are very different in this State from those in flowing or running streams. By "surface-water" is meant, not only that which comes from falling rains and melting snows, but also that which oozes out of the ground from springs or marshy places, and which finds its way over the surface, or through the tussocks, but is not gathered into a bed or current like a brook or rivulet. When once collected into a stream, with a bed and banks, it loses its character as surface-water, and becomes subject to different rules; but, so long as it is only surface-water, any man on whose land it is has a right to detain and use the whole of it on his own land and for his own purposes, and is not bound to let any portion of it flow on to the land below, unless he wishes. On the other hand, he may turn the whole of it on to the premises below him, whether grass-land or cultivated field, even though it be a serious injury to such neighbor (120 Mass. 99). If the latter wishes to protect himself, he must build up some embankment at the edge of his land, and stop the flow, as he has a perfect right to do, although he thereby makes quite a pond above, and injures the crop there. And as the farmer may turn the surface-water from his own land into yours, without being liable, so a highway surveyor may conduct the road-wash on to you, even though it sweeps sand and gravel into your best mowing. If he turn a *water-course* on to you in that way, you cannot sue him (15 Gray, 486), but may appeal to the selectmen, under General Statutes, chap. 44, sect. 10, to have it changed; but surface-water you must take or dam it up: that you can do, but you ought not to *damn* the surveyor for turning it on to you.

As to *under-ground* water, the law does not recognize any right of ownership therein; and consequently, if your neighbor's well is fed by springs or under-ground rills from your land, you may dig down on your land to any depth you please, even near to the line; and if, by chance, you cut off the supplies to his well, and leave it dry, he must bear it as well as he can (18 Pick. 117). But you must be careful in digging not to let his land cave into your excavations, or you may be responsible therefor.

TRESPASSING ON THE FARM.

The general rules in regard to trespassing on another's lands are pretty well understood in the community, but on one point there is sometimes an errroneous impression. It is often thought, that, if a person simply crosses your land for twenty years, he thereby *always* acquires a right to continue the practice; but this is far from being universally true. The very foundation of acquiring such a right (prescriptive right as it is called) is, that the crossing must have been adversely to the land-owner, contrary to his wishes, or at least without his permission, express or implied, and under a claim of a legal right so to do, whether the farmer is willing or not. If, therefore, the person crossing does so with the permission, or by the mere indulgence, of the land-owner, and not under any claim of right, it is wholly immaterial how long the custom has continued. Forty years' travel by consent of the owner would not give any right to continue to pass after he had been forbidden to do so; and, to avoid any misapprehension in such cases, it is wise for the farmer to put up notices forbidding it, as we so often see done. And this not only makes it clear that thenceforward the intruder is a trespasser; but, by a recent law in this State, he is also made liable, after such notice, to a fine of twenty dollars for wilfully crossing or entering upon any garden, orchard, mowing-land, or other improved land, between the first day of April and the first day of December (St. 1876, chap. 181).

By this law the wilful trespassing on such lands during the summer and fall months is made a crime; and any constable or other officer may arrest the offender on the spot, and take him before some proper tribunal for trial and sentence. But at all other seasons of the year, or as to any other kinds of lands, such a trespass is only a civil trespass, not a crime, and the only legal remedy is by an action for damages done, which may be very unsatisfactory.

If, however, a man's object in coming into your premises is to steal your fruit, cranberries, or other crops, that itself is a crime, although he does not accomplish his purpose; and you may put him out by force, after notice to leave, using no unnecessary violence. But you cannot lawfully set spring-guns, man-traps, or other instruments which may do him grievous

bodily harm, without giving notice of such hidden dangers (4 Bing. 628; 37 Iowa, 613; 31 Conn. 479; 7 J. J. Marsh, 478). The old school-books, in my early days, had a picture of boys stealing fruit in the boughs of an apple-tree, with a farmer picking up stones, and a maxim, that, if words and grass did not answer, he might throw stones. But, if in so doing you should happen to put out the boy's eye, it might go hard with you; for you have not a right to kill even your neighbor's hens while scratching up your melons and cucumbers. The custom to do so, and toss the fowls over the fence, may afford some satisfaction to the gardener; but it makes him liable to pay the full value of the nuisances, although he had repeatedly warned their owner to keep them at home, or take the consequences (14 Conn. 1; 107 Mass. 406). Whether this rule applies to an old cat which is after one's chickens, I don't know; but I mean to try it the first chance I have.

One of the most annoying forms of trespass to the farmer is that of hunting and fishing. Many persons seem to suppose, that by force of some general custom, or otherwise, they have a right to hunt or fish over another's ground as they please; but this is quite erroneous (4 Pick. 145; 13 C. B. (N. S.) 844). In all ordinary streams and ponds the right to fish belongs solely to the person owning the adjoining land. If the stream is navigable,—that is, if the tide ebbs and flows,—the public have a right to boat up and down it, and to fish from their boats, but not to go on shore to do it. And, by a very early law in Massachusetts, if a farm contains a "great pond,"—i.e., a pond containing over ten acres,—the public have a right of fishing and fowling there, "and may pass and repass on foot through any man's propriety, for that end, so they trespass not on any man's corn or meadow."

The recent laws authorizing fish commissioners to lease large ponds to private parties may, of course, modify the former rights of the public therein.

As to salt-water fishing, the law is somewhat peculiar; for although the owner of the upland ordinarily owns the land down to low-water mark, as before stated, yet any other person may go there, and dig clams or other shell-fish, if he can do so by water, and without crossing the upland in going or returning (8 Cush. 347; 7 Gray, 440). The Legislature

may sometimes abridge or modify this right; but the ordinary rule is as above stated.

OVERHANGING TREES.

The question often arises who owns the fruit of a tree standing near the boundary-line between two proprietors. It is generally supposed that the fruit on the limbs overhanging one's land belongs to him; *but this is an entire mistake.* If a tree stands wholly on your land, although some of the roots extend into the soil of your neighbor and derive support and nourishment from his soil, he has no right to any of the fruit which hangs over the line (11 Conn. 177; 38 Vt. 105; 25 N. Y. 126); and, if he attempts by force to prevent you from picking it, he is liable for an assault and battery (46 Barb. 337; 48 N. Y. 201).

In one instance a lady, while standing on the fence picking cherries which hung over the line, was forbidden to do so by the adjoining owner, who was at work in his garden; and, in the scuffle to prevent her, she received some bruises on her arm, for which he had the pleasure of paying the neat little sum of a thousand dollars. If your fruit falls into your neighbor's lot, you have, I think, an implied license in law to go and pick it up, doing him no unavoidable damage (113 Mass. 376; 12 Vt. 273).

If, however, a fruit-tree stands directly in the division line, and is what is called a "line tree," both parties own the tree and fruit in common, and neither can cut down the tree, or seriously injure it, without being responsible to the other (12 N. H. 454; 34 Barb. 547; 25 N. Y. 123).

Sometimes persons are tempted to poison or secretly kill a neighbor's tree of some kind, which stands near the fence, and casts a baneful shade on their garden-plot: but this is dangerous business; and the party doing so may possibly find himself inside the county jail for a twelvemonth, where the rooms are apt to be small, and not always very clean! The safer way in such cases is to cut off the limbs which hang over your side, or dig down and cut off the roots, which undoubtedly you have a legal right to do; but it would not be safe to use the limbs for firewood, or otherwise convert them to your own use, lest you have to pay their value, more or less.

FINALLY.

Time will not allow me to speak of the general laws of purchase and sale, or of deceit and warranty, about which so much may be said; but there are two phases of it of special interest to the farmer. One is the disappointment resulting from the purchase of impure or spurious garden-seeds. It is now well settled, that if a dealer in seeds sells an article marked and put up under a certain name, and it is so billed to the purchaser, this amounts to an absolute warranty or guaranty that the seeds are what they were bought and sold for; and, if they turn out not to be, the farmer has a remedy against the seller for the money he paid for the seed. And this is so, although the seedsman was honest in the sale, and bought them for exactly what he sold them for; and he would have a remedy back on the person who sold to him (18 Q. B. 560). But merely to recover back the money paid for the seed would fall far short of the loss to the buyer. His time, labor, fertilizers, profits on his crop, are all gone; and the question has been much agitated, whether the seedsman is liable for all this loss. And it is now generally understood, that when he either expressly warrants the seed to be of a particular kind or variety, or when he so sells it without any reservation or limitation, and thus creates an *implied* warranty, he is liable for all the damages directly flowing from the farmer's use of such seed.

In one instance a market-gardener bought of a seedsman "early strap-leafed, red-top turnip-seed," but which proved to be "Russia late," not salable in market, and only fit for cattle; and he was allowed to recover of the seller the difference between the value of the crop which was raised and a crop of early turnips on the same soil, even though the seedsman honestly thought the seed was as represented (7 Vroom, 262; 9 Id. 496; 34 N. Y. 634). And in case the farmer is so imposed upon, and the seed proves *entirely worthless*, and his crop of no value, he can make the seedsman pay not only the cost of the seed, but also for all the labor incurred, and the fair profit he would have had from the crop, had the seed been what it was represented to be (69 N. Y. 62). To avoid this serious liability, seedsmen at the present day very often print upon their seed-packages

that they do not warrant any seed they sell, which may perhaps relieve them from their responsibility, unless they knew the seed was not true to name.

The other subject to which I alluded is the "lightning-rod nuisance," so called. For several years past the agricultural community has been overrun by swarms of unprincipled men offering for sale "improved lightning-rods," "patent pitch-forks," "white-wire clothes-lines," &c. With persuasive cunning they prevail upon the farmer to accept the agency for the sale of the article in his town or county, with reckless assurance of the profits to be realized therefrom. They ask him to sign a printed contract for that purpose, which he unsuspectingly does. The articles either never come to hand, or, if so, they are worse than useless; and the agent thinks that is the end of the transaction, and writes to have the rubbish taken away. A few months afterwards another man comes round, — a confederate rascal with the former, — and presents the farmer with his printed promissory note for a hundred dollars or more, and pretends he bought the same in good faith, and demands payment. The signature to the paper is genuine, and the farmer is amazed to know how it came there. Nothing but a law-suit will reveal the fact that the strip of paper now presented has been cut off from the bottom of his agency contract, and made to appear a very different affair from the real one. The honest farmer is in the hands of a set of accomplished villains; and in many instances their plans have been so well laid, that either he is compelled to pay the whole note, or, to avoid the expenses of a law-suit, compromise the claim. Beware of these miscreants; shun them as you would a rattlesnake. If there is one place hotter than another in the world to come, they deserve that corner, living as they do upon premeditated, cold-blooded fraud and deception.

I have thus imperfectly touched upon some of the leading rights and liabilities of farmers; and if, in the brief time allotted me, I have been able to impart any valuable information, or save you from the many entanglements of the law, or even to interest you but for the passing hour, my purpose has been accomplished.

QUESTION. If your cattle come on my farm, and I turn them into the street, and they do your neighbor an injury am I liable for it?

Judge Bennett. I do not think you would be.

Question. How is it about gas-fixtures in a man's house?

Judge Bennett. I purposely omitted gas-fixtures, because it is a mooted question yet. For every case I have stated I have found direct, positive authority in the decisions of the best courts in America; but, inasmuch as I found there was a difference of opinion among different tribunals on the question whether gas-fixtures pass with the house or not, I purposely omitted saying any thing about it.

Question. Have I a right to take any material from the road-side for my own private use?

Judge Bennett. Against your own land, undoubtedly. The land-owner has a right to any thing of value on the surface, or below the surface, of the road, unless the highway surveyor puts in his claim to it for the repair of the road. As against anybody else, his claim is as perfect as to his own well or his own kitchen. He must not injure the road, of course. That is to say, a man would not have a right to dig a pit in the highway, and leave it open there, and take away the material to use on his own land. He is not liable because he takes away the material; but he is liable because he did not fill up the hole. He has a right to the material, unless the highway surveyor wants it.

Question. Suppose there is a gravel-bank, and I want the gravel to use?

Judge Bennett. You have a right to it, unless the surveyor objects to your taking it. You own it; it is yours: why shouldn't you take it?

Question. If the limbs of my trees hang over the fence, and shade another man's land, has he a right to stand on the fence and cut those limbs off?

Judge Bennett. Undoubtedly. I stated that as clearly as I could. Every man has a right to use his own land. If the limbs of my trees hang over his land, and he wants to prune up, he must prune on his own land; but he has a right to cut the limbs of my trees off, because I have no right to allow my trees to grow so as to prevent his using his land.

Question. Suppose I have a cellar near the boundary of another man, who owns a cranberry-meadow; and he flows

that cranberry-meadow, and the water on account of that soaks into my cellar, have I a right to go and lower his dam so as to prevent the water soaking into my cellar? It does not flow there, the surface having been raised; but it soaks through, and damages my cellar.

Judge BENNETT. I think not. Perhaps I gave the key to that as far as I could. Inasmuch as the law does not recognize any proprietorship in water, or any liability for water, that runs under ground, the cranberry-man has a right to flow his cranberry-land, and let the water go where it will, — down to China, or on to your land.

Mr. WILLIAMS. In relation to manure conveyed by the sale of a farm: I want to ask whether it would make any difference if the manure was made by animals on the farm, or bought and carried on to the farm, not the product of the farm?

Judge BENNETT. I think not. The foundation of the rule is, that the manure becomes a part of the land, whether it came from one animal or another. The moment it is deposited on the land, it becomes affixed to the soil. If somebody else had deposited it there for a temporary purpose merely, of course it does not pass with the land, because the owner of the land does not own it.

QUESTION. Have the highway surveyors a right to use the timber on the highway?

Judge BENNETT. Yes, sir. If they wanted to build a bridge, I suppose they could use the timber on the road.

QUESTION. Has the highway surveyor a right to forbid my using the gravel which lies beside my land, because he may suppose that he will want to use it at some future time?

Judge BENNETT. I suppose he has, because he has the first right to use it. Even if he does not want to use it at the time, he has a right to forbid your using it, if it is probably reasonably necessary for the repair of the highway.

Major PHINNEY. I want to inquire if I understood you correctly as saying that if the water is obstructed in a drain running through another's land, and flows back on my land to my injury, I have a right to enter his premises, and remove that obstruction.

Judge BENNETT. I meant to say so decidedly.

Major PHINNEY. Can I do so without liability to prosecution?

Judge BENNETT. Of course; else you could not do it. When I say you can do it, I mean you can do it lawfully. I will refer Major Phinney, who is a man of the law, to two decisions of the Supreme Court (in 5 Metcalf and 21 Pickering), in which that very question came up.

QUESTION. If a neighbor builds a fire on his land, and it runs across his land, and burns up the boundary-fence between him and another man, is the man who builds the fire responsible for the damage?

Judge BENNETT. That depends entirely on the question whether a jury would say he was negligent in building that fire at that time, or in managing it after he built it. If he should build it on a very windy day, when it was dangerous for any man to build a fire, I suppose they would convict him of negligence. Or, if he did not have men enough to watch it after he built it, they would be likely to find the same. But he has a right to build a fire, unless he is negligent.

QUESTION. Are the chains and ox-bows used in a barn for tying cattle conveyed with a deed of the barn? and in a case where there is a chimney with pipes running down three or four stories, connected with stoves in the lower part of the house, are the pipes conveyed with the house?

Judge BENNETT. I think the ox-bows, &c., would go with the oxen, and not with the barn, unless affixed to the barn: therefore the deed would not convey them. The pipes would not go, unless they are so attached to or plastered into the building that they cannot be separated from it without destroying more or less the chimney to which they are attached. A cook-stove, with a pipe running into the chimney in the ordinary way, does not go with a deed of the house; but the owner may remove it.

QUESTION. I would like to inquire what constitutes improvement of land, — whether the chopping of wood from a wood-lot for family use, or cutting a set of bean-poles for use in the garden, constitutes an "improvement" of that land.

Judge BENNETT. I should think not. I don't think the law would require a man to keep up a mile of fence because he had cut a few bean-poles on his land.

Dr. WAKEFIELD. Does the principle stated in regard to manure apply to manure in the barnyard at the time of the sale, as well as to manure outside?

Judge BENNETT. It does apply to all the manure on a *farm:* that is what I was speaking of. But if a livery-stable keeper should sell his stable, with piles of manure around it or in the cellar, that manure is said by our law not to pass by deed. The deed of a farm conveys the manure, because the purchaser wants the manure on the farm, and expects to buy it with the farm, and therefore the law ordinarily gives it to him, unless it is reserved.

Dr. WAKEFIELD. It makes no difference whether it has ever been moved or not?

Judge BENNETT. No, sir, if still on the land sold.

QUESTION. If the public pass over land for twenty years, do they acquire a right to pass over it?

Judge BENNETT. No, sir; not if they pass with the owner's permission. They would not acquire a right in a hundred years if they went with the permission of the owner. They must go against the owner's wish, under a claim of right to do so. In that way they would get a right to do so in twenty years.

QUESTION. If I allow a person to go to my well and take water, year after year, and continue to do so for a quarter of a century, does he acquire any right from me by that?

Judge BENNETT. I don't think he would if he went three-quarters of a century: otherwise, you might not be neighborly and let him come, if you supposed he was getting a right.

QUESTION. Suppose a tree stands on my neighbor's land within a foot of the fence, and I see fit to drain my land, and in doing so cut off the roots, and kill that tree?

Judge BENNETT. You have a perfect right to do so.

Mr. PERRY. If I should buy a piece of land of you, and take a deed, and fail to record it for five years, and you take a notion to sell that land again, and you sell it to another man, who pays you for it, and puts his deed on record first, who holds the land?

Judge BENNETT. He does, unless he knew you had that deed before. If he did, then he cannot hold it, because that would be a fraud on you. That is what the record is made

for, so that every person shall know who owns the land; and, if a man does not choose to get his deed recorded, he is to take the consequences.

QUESTION. If he did not know it, can he hold it?

Judge BENNETT. If he did not know it, he can hold it.

QUESTION. Then would you be responsible to me for whatever loss I might sustain in being obliged to give it up?

Judge BENNETT. I don't know as I should, to that extent. It was your folly that you did not get it recorded.

QUESTION. Have highway surveyors, in opening a water-course for taking off surface water, any right to go on a man's premises in opening the course?

Judge BENNETT. No, sir: I think not. They may turn the water on to him from the road, and he must take care of it after it gets there.

QUESTION. If the boundary-line of land is a running stream, and the current changes, what effect does it have upon the original line?

Judge BENNETT. By our law in Massachusetts, it leaves it just as before. The piece cut off belongs to the same man it did before. There was a case on the Connecticut River a few years ago, where the stream changed, and cut off a piece of a man's land; and the opposite owner said the current ran around there, and he was going to have that piece. The Court said, "No: you can't have it."

QUESTION. If flash-boards are put upon a dam, and the water consequently flows back upon the land, would the owner of the land have a right to go and knock those flash-boards off?

Judge BENNETT. I think he would, unless it is the case of a mill.

The CHAIRMAN. Gentlemen, the Committee of Arrangements have requested Mr. FLINT to fill a gap which happens this afternoon, by some remarks upon cattle-husbandry; and, if you will give your attention to Mr. Flint, I think he will interest you.

THE PRINCIPLES OF BREEDING.

BY CHARLES L. FLINT.

In conversing with several farmers since coming to this meeting, I find some regret expressed, that greater prominence had not been given in the programme to the subject of cattle-husbandry. The reason for the omission was, that the subject has been thoroughly discussed at former meetings of the Board, often with the aid of distinguished scientific men like Professor Agassiz, and of many practical breeders of stock; and there seemed to be a propriety in adapting the programme to what was supposed to be the points of greatest interest in this locality.

Now, as Judge Bennett is obliged to leave at this point, so that we are compelled to lay the subject of farm law upon the table, the Committee of Arrangements suggest that the short time remaining this afternoon be devoted to the consideration of this subject, and that I open it with some remarks upon the general principles involved in the breeding of our domestic animals. It is a subject to which I gave considerable space in my treatise upon "Milch Cows and Dairy Farming," published some years ago; but it is as interesting now as ever, and in fact it is constantly recurring in the every-day life of the farm.

Nature works according to fixed rules, which have received the general designation of natural laws. It is true we may find exceptions. Difference in circumstances will sometimes lead to a variation in results; but still there is, through all experience, a connected thread of evidence of the existence of well-established laws, and these laws, in their application to the stock upon the farm, may be comprehended under the general term of the PRINCIPLES OF BREEDING.

Nothing need be said of the importance of farm stock: it is daily becoming more clearly recognized and appreciated; and so is the fact that the principles applicable to the whole class can be studied and determined all the more satisfactorily by studying individual cases. What farmer has not observed the marked difference in the fattening capacities of his various animals? Some of them fatten so easily, that they pay by their increase of weight for all the food which they consume; while others would be expensive could they be re-

ceived as a gift. The same thing has been observed, though it may be less apparent, in our dairy stock. Some animals, by their abundant yield, or by the quality of their product, pay richly for all the food they consume; while other animals fall far below this point, and entail a constant loss or expense upon the owner.

Now, we want to search out the rules which govern the results we seek to obtain, and to study the system to be pursued in putting them in practice; and it may serve to encourage us, to know that certain results seem uniformly to follow the same fixed laws in the breeding of all varieties of farm stock, as cattle, sheep, swine, &c.

You have heard of the old and well-recognized maxim that "like produces like;" but this rule, as all others, is liable to be misapplied, and the error will appear in the form of contradictory results in practice. If an animal is capable of transmitting any characteristic to its young, it must, of course, possess that characteristic itself, although now and then qualities may predominate in the offspring which were almost or quite latent, or hidden, in the parent. Now, if any characteristic quality becomes hereditary in an animal, it must correspond with a similar quality inherent in the parent from which it descended. But if we breed from a female of certain qualities by a male of an opposite character, so far as these peculiar qualities are concerned, we cannot expect to perpetuate in the offspring both characteristics. We should obtain a result which might appear to contradict the maxim that "like produces like." And here we come at once upon one of the leading principles in the breeding of all stock, — that though "like produces like," and can produce nothing else, when the two parents possess opposing or unlike qualities, the one which possesses the strongest hereditary qualities, or the strongest power of transmitting his qualities, will gain a preponderating influence over the offspring.

Take, for instance, a cow with some special peculiarity of form, and put her to a bull having points of form quite opposite in this respect, and the calf will take the character, so far as this peculiarity of form is concerned, of the parent which possessed the greatest hereditary power, or the greatest purity and unity of influence, — what we may call fixity of

type. And these hereditary powers are very largely under our control, to be increased or diminished by our own course of action.

If we take two animals to breed together, both possessing a strong similarity of type, the result we shall have will be an offspring possessing the like character, but in a higher degree. The result of putting together two animals of a strong similarity of characteristics is not only to perpetuate their corresponding peculiarities, but to intensify them in the offspring; that is, if the parents actually possess a striking similarity of type in any given point, each successive generation which they produce receives an increase of hereditary force, or an increase of power in transmitting its peculiar stamp upon its young. It is a cumulative power. But if this hereditary power accumulates, and becomes stronger and stronger, with a strong similarity in the parents to start from, it absolutely and invariably diminishes, if the parents, instead of possessing similarity of character, really possess an opposite or antagonistic character.

It reminds us of the familiar and well-known principle of mathematics, that two plus or positive quantities multiplied together will produce a far larger plus or positive quantity as the product; while if we multiply two unlike quantities, a plus and a minus, for instance, the result will be a minus, or negative quantity.

Professor Tanner, who is entitled to be regarded as high authority on this and kindred subjects, puts the matter somewhat like this: —

Suppose, for example, we have a well-bred ram, that, by long and careful breeding through several generations, has acquired certain strong and valuable hereditary powers; and suppose these powers, for the sake of illustration, are equal to 100, if they could be expressed in figures. Now, suppose we put this ram to a ewe of a different character, one that has been cross-bred, or bred without any care or system, — very much as our native sheep or our common cattle have been bred. She has, of course, far less hereditary power, far less fixity of type and strength of blood, as we say. Her hereditary power may be represented, we will suppose, by 60. The result would be a lamb possessing very much the same characteristics as the ram, because we have

seen the ram possessed a greatly superior hereditary power. To the eye he may look very like his father: but the hereditary capacity of this lamb will be greatly reduced, and his power of transmitting his peculiar characteristics will be represented by $100 - 60 = 40$. He may still look to the eye about as good as his father; but he will possess less than half of his father's hereditary power, and less even than that of his mother. In other words, he may have all the perfection of form and marked characteristics; but his power of transmitting these peculiarities will be only in the proportion of 40 to 100, and for a breeding animal to get stock from he will be worth less than half as much as his sire.

In other words, if you select animals of a similarity of type, that is, if the likeness is strongly marked and well developed in both parents, the young will not only possess the same character as the parents, but it will possess an increased or multiplied power of hereditary transmission of these characteristics. But opposite characteristics mutually weaken each other's influence, and the offspring will have the power of hereditary transmission only in a greatly reduced degree. The exact proportion of this reduction of the power of transmission, or hereditary power, may not be precisely like that stated by Professor Tanner; but it will correspond with it in the main, and sufficiently for illustration.

These are a few general and well-established principles which have been arrived at by the most skilful and scientific breeders during the last half or three-quarters of a century; and it would be idle to dispute them, or to deny their force.

We are to bear in mind also, that this capability of transmitting the qualities or characteristics from the parent to the offspring is not limited to any one peculiarity of the animal, — like the secretion of milk, the disposition to take on fat, the strength of constitution, the likeness of figure, or the habit of growth, — but extends to all the characteristic points of the parent animal. All the peculiarities of the system, physical and constitutional, are very largely within our control; and the character which results will be governed by the tendencies of the parents we select to breed from, and will depend on the adjustment of the balance of qualities,

sometimes inclining to the side of one parent, and sometimes to the other, according to the respective power of transmission which has been spoken of.

If this power largely preponderates in one parent, owing to the length of time in which it has been carefully bred, or the number of generations through which it has become fixed and intensified, while it has been broken and weakened in the other by cross or promiscuous breeding, the character of the offspring will be governed almost exclusively by the parent that has the stronger blood; while the other will have but slight influence over the qualities of the offspring. But if there is a more even adjustment of this power of transmission on the part of the parents, — that is, if they are nearly or quite equally well bred, — the dam will succeed in imparting some peculiarities, and the sire will communicate others. The dam may impart the general form of the body, for instance, but be unable to control or overcome the stronger power of the sire over certain points of the body. The dam, for example, might have slightly deficient hind-quarters, and the sire a strong tendency to impart a good hind-quarter; and in this respect she would be compelled to yield to the superior strength of influence. In those points of character or features where they correspond, or were similar, both being good or both being bad, the result would be to increase and intensify such points, and to reproduce them in a still stronger form. In some particulars the influence of the male will predominate; in others, that of the dam. So you see the hereditary qualities of long and carefully bred stock will represent the maximum of good qualities and the minimum of undesirable ones.

If I have succeeded in making myself understood, you have already a few of the most important general principles from which the judgment of each breeder will enable him to deduce many details to be applied in practice; and the first and most obvious is to BREED ONLY FROM THE BEST,—not merely the best looking, the animal that strikes and fills the eye the most completely, but from the one that has the hereditary power, the capacity to transmit his good qualities in the highest degree to his offspring; and the strongest evidence of this power will be the length and perfection of his pedigree, showing the qualities of his ancestors for some generations

back, unless, indeed, some of his stock can be seen to tell as plain a story to the practised eye of a judge of stock.

We have often heard practical men, intelligent men, who profess to know something about stock, and who ought to to know better, say, "I don't care any thing about your pedigree: let me see the animal, and I can tell whether I want to breed from him or not." Let us not deceive ourselves by any such assumption, from whatever source it may happen to come. It will be sure to lead to frequent disappointment; for, as we have shown, an animal may possess an almost faultless form, and strike the eye of even the most experienced judge as possessing remarkably fine qualities, and indeed really possess them, and yet have no fixity of type, no great hereditary power; when, if put to a low or ill-bred female, he will be more likely than not to get poor stock, or, at any rate, there will be no reasonable certainty of transmitting his own qualities.

The importance of the greatest care in the selection of the male will be apparent from the fact that his influence extends to a far more numerous progeny. He should not only possess in the highest degree the good qualities sought after in the class of animals to which he belongs, but he should possess the power of transmitting them in the highest degree; and as this power is latent or hidden, and does not appear to the eye, it is to be judged either from the stock already got, or more commonly from the qualities of his ancestors through several generations. And here, again, the quality of the pedigree — that is, the quality of the ancestry — is more important than its length. It is of little use or satisfaction to trace a pedigree back through inferior or ill-bred stock, except as a warning against the use of the male at the end of it.

At the same time, the longer it is, the better, provided it shows a high character in the ancestry; for we have seen that the hereditary power, or capacity for transmission, is cumulative; that is, becomes stronger, and more intense and fixed, from generation to generation, where the respective parents possess similarity of characteristics, as is commonly the case in our well-established breeds.

I have said that the choice of the male to breed from is of special importance, because of the great extent of his

influence; that is, the very large number of his offspring, in proportion to that of the female, among our domestic animals. But it is well established now, that the influence of the male imparts vigor of body and the general conformation of the system, especially of the forward parts, and that he transmits to his progeny the qualities of the mother by which he was born. A well-bred bull dropped by a first-rate dairy cow will produce a calf that will make, if a heifer, another good dairy cow. He will transmit to his daughter the qualities of his mother, if he have well fixed in his constitution the hereditary power of which I have spoken. In breeding dairy stock, therefore, it is of the utmost importance to study and to know the quality of the stock from which the male has descended.

There are three objects which the general breeder desires to gain, with a view to profit, and each requires a mode of proceeding peculiar to itself; and any departure from this mode will be sure to result in loss, or failure to attain the special object in view. The first is the production of milk.

The milking or dairy qualities of our stock have a wide range of development; that is, they are not confined to any one race or class of stock, but are found, to a greater or less extent, in cows belonging to all the well-established breeds, and in many individuals among our common stock, though some breeds or families of animals have been raised with greater attention to the milking qualities than others. In other words, high milking or dairy qualities are now the rule in some breeds, while they are the exception in others. The mode of feeding has much to do with the practical results in the dairy. Still, the quantity of milk which an animal, a cow, for instance, is capable of secreting, depends very much upon the supply of blood which passes into the mammary glands, but especially upon the activity of those glands; while the quality of this milk depends upon the internal structure of the cow.

The animal in a wild state, or in a state of nature, has stronger reproductive powers, greater energy of the system and constitution, than one long under the influence of domestication. The natural laws are to some extent interfered with by the efforts we have to make to establish and perpetuate certain peculiarities of the animal system, the ex-

traordinary development of which is unnatural and artificial, but which development may be essential to our interests. The tendency to secrete milk is a natural one, found in all animals that suckle their young; but the extraordinary development of milking powers is *artificial.* In the wild state the cow yields milk for only a short time, and that only in sufficient quantities, probably, to nourish her young. As we recede from this wild condition by domestication, and subject the animal to a variety of circumstances which modify her form and system, we do it at the expense of certain qualities, for the sake of gaining other qualities better calculated to promote our immediate interest. The reproductive powers become weaker, the vitality and vigor of constitution lessened; but the formation of fat, or the tendency to produce meat, and the profitable production of milk, may be largely increased. That high breeding has this tendency to diminish the vital force and strength of constitution, is apparent enough when we consider how utterly absurd it would be to attempt to pit an improved short-horn bull against a rough and ill-bred bull in a Spanish arena. He would have the improvement knocked out of him before he had time to turn round.

Good dairy qualities, therefore, being artificial to a great extent, there will always be a natural tendency to revert to the natural state; and hence the necessity of constant and unremitting care to preserve and improve by the methods already intimated what we have already gained; that is, by the most careful selection of the animals from which we propose to raise dairy stock, especially to have the male from a family remarkable for milk.

It is a fact well known among farmers, that in all classes of stock, as cows, ewes, sows, &c., a strong disposition to accumulate fat in the system is commonly attended by a marked deficiency in the secretion of milk; and there can be no doubt that the general structure of the animal exercises an important control over the quantity and richness of the product in milk.

This must be evident from the fact that the first process which the food taken into the system is made to undergo after digestion is the separation and preparation of the fatty and nutritive parts, so as to introduce them into the circula-

tion of the blood. In some animals this process apparently goes on with less loss than in others; but the rapidity with which the elements of food pass on into the circulation of the blood is plainly seen in the shortness of time it takes to show itself in the various secretions of the body. Thus, certain plants or other substances taken into the stomach half an hour previous to milking will perceptibly affect the taste and quality of the milk. If you administer a dose of aloes to a horse in the form of a ball wrapped up in paper, and within twenty or twenty-five minutes after put a bullet through his head, and dissect him, you will find the paper left in an undigested mass in the stomach; but you will find traces of the aloes far along at the very mouth of the large intestine. It has dissolved and entered with wonderful rapidity into the circulation of the system. That has been tried time and time again. It is related, also, that an ox going to the butcher caught up an onion, and ate it. In a very short time he was knocked in the head, when it was found that the onion had tainted the whole body.

The completeness and economy of this separation of the fatty elements of the food vary according to the internal structure and organism of the animal itself. We cannot, perhaps, tell exactly how this happens; but the fact is well known. Perhaps it is owing, in part, to the fact that one animal will masticate, or grind up and digest, its food more perfectly than another, and so prepare it to enter more completely into the circulation.

Now, milk is supposed to be secreted from the blood. I adhere to the commonly accepted theory for the present; but I am not unmindful, of course, that some of the German physiologists, like Fürstenberg and Voit, take the ground that the formation of milk requires the actual decomposition of the mammary glands themselves, or the substance of the cellular tissue, by which they are transformed into sugar of milk, caseine, &c., with a fatty degeneration. They maintain that milk is simply liquefied cellular tissue, and that it does not depend for its abundant supply upon the quantity or quality of the blood. They base this deduction on the fact that caseine, which enters so largely into the composition of milk, is not found, as such, in the blood itself, but results from the first process in the decomposition of the gland-

cells; while the sugar of milk, also wanting in the blood, is another result of this decomposition. According to them, milk is formed by the transmutation of gland-cells; or, in other words, the globules of milk were once cells or tissues of the mammary glands, and not merely an exudation, or a sort of straining of the blood through these glands.

But other physiologists, whose opinion is entitled to equal weight, maintain that the office of the milk-glands is chiefly to separate the materials requisite for the formation of milk from the blood, and to transform them into the constituents which we find in milk, especially in milk-solids. They take the ground that the caseine of milk is formed from the albumen of the blood through the agency of a peculiar ferment which is found in the milk-glands; and that the increase of the caseine is always at the expense of the albumen of the blood.

Without entering into this controversy, it is apparent, at least, that the large amount of water in milk must depend directly upon the blood itself, and upon the food which the animal takes; for we know perfectly well that very moist or succulent food causes the milk to be thin and watery as well as abundant, showing that there must be a diffusion of water directly from the blood. It is incredible that such great quantities of water could be obtained from the decomposition of the gland-cells; and, as water constitutes by far the largest part of milk, it is practically correct to describe it as a secretion from the blood, even if we admit that the milk-solids have their origin in the decomposition of the mammary glands.

Now, if the blood is poor, thin, and watery, if it is but slightly charged with the fatty elements which have been taken up in the food, the quality of the milk secreted from this blood must of necessity be poor, because the quality or richness of milk is supposed to depend on the amount or proportion of fatty constituents, or what is more commonly known as cream and butter. And you will generally find that the quality bears an intimate relation to the quantity produced.

The second step in the process of assimilation is, therefore, the separation of a larger or smaller proportion of these fatty elements in the blood, in the form of milk, the richness of

which will be governed very materially by the food and by the perfection, the completeness, with which the fatty elements have been separated from the food, and enter into the circulation of the blood.

One animal may perform the first operation — the separation or elimination of the fatty matter in the food to be stored away in the blood — as well as another, and, if so, they accomplish the first step in the process of conversion with equal economy; and so far as this goes, — that is, the separation and accumulation of fatty matter in the blood, — it is the same whether the subsequent use to be made of it be to form the fat or butter in milk, or the fat or tallow of the body.

Now, after this storing away of the fatty elements in the blood, it will still depend largely upon the structure and organism of the animal whether it will be deposited in the form of fat, or secreted, — given up by the blood in the form of the cream of milk.

We see, therefore, that the economical preparation of the raw material of the food is equally important for the fat in the blood, whatever may be the ultimate form into which the animal system is to convert it; and the internal structure which accomplishes this process differs widely in different individuals, so that one animal will effect this separation, preparation, or elimination, completely, with the least possible loss or waste of food; while another will fail to extract the fatty elements of the food, and allow them to pass on to be excreted with the other cast-off wastes of the body; and we see, also, that animals best formed for fattening are also best formed to fulfil the first condition essential for the production of rich milk.

We have then arrived at the point where the fatty portions of the food have entered into the circulation of the blood, and are now to consider the influence of the living animal system over these substances; that is, the elimination or secretion of either fat or milk.

There are organs for the deposition of fat as well as for the secretion of milk. The former are called adipose tissue; the latter, the mammary glands; and whether these fatty matters in the blood are to be changed, or deposited in the form of the one or the other product, will depend mainly upon

the comparative activity of the one or the other set of organs. Both these organs are subject to the breeder's influence. If we breed so as to enlarge and stimulate the adipose tissue to great activity, we produce an animal whose constitutional predisposition is to accumulate fat. If, on the other hand, we increase the activity of the mammary glands by breeding and feeding with special reference to this object, we develop the size and activity of these glands, and the result is an animal that will yield large quantities of rich milk. The form, size, position, and functions of these organs, come more properly into the department of animal physiology, and we have not time to devote to them. It is sufficient here to say that the mammary glands are stimulated to special energy after the birth of the offspring; so that this activity becomes superior to the tendency to form fat: and at such times, if the food is deficient in oily matter, the fat already laid up in the system is again taken up into the circulation, and goes into the formation of milk.

So you see, when the mammary glands are acting in a healthy and energetic manner, the fatty matters of the blood which passes through them are secreted in the form of milk, and, if these fatty matters are deficient, the fat already laid up in the cells of the adipose tissue is dissolved, and goes on in the circulation to form milk; and if this fat gives out, and is not kept up by the food, the very substance itself of the adipose tissue is capable of absorption into the system, so that ever after it will become more difficult for the animal to take on fat. This explains, perhaps, the difficulty of bringing up an animal that has become emaciated, what is called "hide-bound." The adipose tissue — the organs whose function it is to deposit fat from the blood — is gone, dried up, absorbed in the system.

Now, in some instances, the mammary glands get into an unnatural and torpid state, lose their energy to such an extent that even the birth of the offspring is not sufficient to call them into activity and excite them to energy. In such cases, even with good food, and with all the rich, fatty elements in the blood which courses through these glands, they fail to appropriate it as milk; and the blood will pass on to carry its rich treasures to other parts of the body.

Our object in breeding stock for the dairy, therefore, is

to stimulate these glands to the greatest possible activity, to increase their natural energy and power of secretion, and to prolong their period of activity. Now, they are so largely subject to hereditary influence, that great progress has been made in increasing their power to perform their natural functions, as we see in the establishment of various breeds of cattle remarkable for milking qualities; while a neglect to develop and encourage the functions of these glands has in some breeds so far reduced their energy and activity, that whole classes of animals — like the Herefords, the Devons, and to some extent the Short-horns — have ceased to yield milk in quantities to be profitable upon the dairy farm.

In those breeds where the tendency to produce meat has been encouraged, where the yield of milk has been overlooked, and sacrificed to early maturity, we could, no doubt, by judicious management, bring the condition of the mammary system to its required standard of efficiency, and even elevate this standard to a high degree; but we should probably injure or reduce the tendency to the economical supply of meat. We should impair the value of certain very important qualities which have been highly developed for specific purposes, and should get only what we find already highly developed in other breeds; viz., a tendency to the largest production of milk. Not that the two qualities are irreconcilable or incompatible in the same animal, which I do not believe, but that they have not as yet been combined with any degree of success in the meat-producing breeds. We find generally in practice that a cow that produces a large amount of rich butter will, when the secretion of milk falls off, feed most profitably for the butcher, unless there are other counteracting or objectionable peculiarities.

The second object we have in breeding stock is the production of meat; and, while upon the general principles of breeding, let me allude to the difference between breeding for the production of milk and the production of meat. For the latter, a large part of the success to be expected will depend upon management, and attention to feeding. It is absolutely essential to keep the animal in a thriving condition from its birth; but still we can exert a powerful influence over the natural predisposition of the animal. We are to choose a female that yields an abundant supply of milk. An

animal — a cow, for instance — that yields a liberal supply of milk will nourish the *fœtus in utero* more completely, and bring larger calves, her offspring will be fatter, finer, and in far better condition at birth, than that of a poor milker. A cow that has a strong predisposition to form fat, and secretes little milk, will almost invariably bring a puny calf, and one out of all proportion to the size and condition of its dam. The cows of the breeds most noted for the production of beef — pure and high-bred Short-horns, for instance — are far from being the best for raising calves designed especially for the most economical production of veal. A well-formed grade or common cow (if in sound health, and capable of nourishing her young) put to a carefully-bred Short-horn bull whose ancestry through some generations had possessed a strong disposition towards the production of fat and meat, will bring forth a larger calf than a high-bred Short-horn. The bull from such a parentage will possess hereditary powers so strong as to transmit all his essential characteristics to his offspring with as great certainty as if that offspring came from a too finely bred cow. This, of course, supposes her to be large and roomy, and well proportioned in size to the bull. But the bull must have the advantage of a good pedigree or careful breeding.

But it would be a fatal mistake to adopt the opposite course, and to put a high-bred pure Short-horn cow to a low-bred or scrub male; for, though the cow would succeed in stamping her character upon the calf, she could not nourish it so well, she would be less hardy in constitution, and not so certain as a breeder. It is far better to impart through the male in breeding the qualities we want for the production of meat; and, in the economical conversion of vegetable into animal matter, purity of blood is not essential in the offspring.

For the breeding of stock for the most economical production of beef, take, therefore, good fair dairy cows of good size, and put them to a bull of first-rate pedigree, — either Short-horn, Devon, or Hereford.

With respect to breeding for purity of blood, the third object we have in the systematic breeding of stock, I need not stop to say much in this connection. Here the object is to create and preserve a fixity of type, and we must select animals possessing the same characteristics in order that

we may invariably reproduce the good characteristics with greater certainty, and in an improved form, in the offspring. If the individual animals be well selected, we shall in every generation gain stronger and stronger hereditary power and permanence of qualities. We shall concentrate the peculiarities of the race or breed. But we must avoid, so far as possible, any opposing influences in the parents, as tending to weaken the hereditary tendency in the young. We are to avoid any thing like crossing with the strictest care.

With respect to the practice of breeding in-and-in, as it is termed, which comes naturally in this connection, many conflicting opinions have been expressed; and the general conclusion arrived at is, that it is safe only within certain narrow limits, and then only under the hands of the skilful breeder.

Breeding in-and-in is commonly understood as an indefinite term applying to any near relationship; but its legitimate and proper application is to designate animals of the same blood as own brother and sister. But a son is only half the blood of his mother, and a daughter is only half the blood of her father. You may breed such relationship together to a certain extent without injury; that is, you may put a bull to his mother or to his daughter, and greatly concentrate the hereditary power in the offspring. But even this course is to be followed with care and judgment, and not pursued too far. After reaping the first advantages to be derived from it, the breeder will do well to stop and consider. Breeding in-and-in, i.e., own brothers and sisters, will give a more perfect form; but, if carried beyond one generation, it will be at the certain sacrifice of size, and perhaps of the strength of constitution. It greatly weakens the reproductive powers, and often leads to other and still more serious evils. Bear in mind that I refer to own brothers and sisters. More distant relationships can be put together with less risk, of course, and, if carefully watched to discover the least injury to the vigor of constitution, this course may be adopted to some extent where the design is to bring up a pure herd having certain highly important qualities which it is desirable to concentrate and perpetuate. At the same time it should be borne in mind that pure-bred animals have now become so common and so numerous, that it will not be difficult to

change the strain of blood sufficiently often to avoid any necessity of breeding from too near relationships. The necessity of breeding from close affinities will rarely exist, except for the purpose of trying to build up a new breed, where, in some instances, it may be unavoidable.

Cross-breeding is the coupling of two animals of different and distinct breeds. Where it is practised for the sake of getting size and early maturity for the butcher, it is often expedient; but, where it is the object to produce animals to breed from, it is never judicious. The use of a pure-bred male upon a mongrel or grade female is not a case of crossing; but the term is often used as between two strains of blood or two families of the same breed. Crossing with the purpose of procuring animals for the butcher offers many important advantages in individual cases; but it is seldom the object upon New-England farms. There are few sections in this State, where, in the case of cattle, it is thought desirable to breed especially for the butcher. But the use of a pure-bred male upon a low-bred female will almost invariably succeed, and produce good results.

Coming now to the application of the general principles of breeding to the details of the breeding of stock for the dairy, we are met at once by a large class of questions on which the minds of practical breeders have long been divided. Among them are questions as to the age at which the young animal intended for the dairy should be put to breeding, — is there any method of influencing the sex of the young? What is the value of Guénon's method of judging the qualities of dairy stock? and how shall we avail ourselves of its advantages, if any, in breeding for the dairy? At what period of the "heat" will the cow be most likely to conceive when put to the bull? Has the first impregnation of the heifer any perceptible influence upon the progeny got by subsequent impregnations by the same or other bulls?

To answer these and innumerable other questions of a similar nature connected with the practice of breeding, grouping together the vast body of facts which bear more or less directly upon them, would require something like a treatise devoted to the solution of each. I can expect to do little more than allude to them, with no attempt at giving them in a systematic or logical order.

In breeding for the dairy, I believe in bringing heifers in at two years old; for the reason that, at that age, the organs of secretion, like all parts of the body, are in a more pliant condition than they will be at a later period, and they are consequently more readily influenced. The secretion of milk is well calculated to develop them, and to enlarge them to their utmost capacity. If the animal is to become a large milker when she arrives at maturity, she must have abundant room to lay away large supplies of milk; and the capacity for holding these supplies must be created while her system is pliant, elastic, and easily influenced.

Let the heifer take the bull towards the end of July, in August, or early in September, if she will, and you bring the parturition in the following spring, at a time very favorable for the production of milk. In spring the grasses are green, abundant, and tender, full of rich milk-producing juices, which cause the largest development of the milk-forming organs.

If, on the other hand, the first parturition of the young heifer takes place in winter, the distention of the udder on dry forage is slight, and the product in milk corresponds. The milky glands will have but slight development. Soon this habit will become a second nature, so to speak, which no amount of feeding can wholly correct. The external signs of a good milker may be there; but the yield does not come up to the production which they indicate; and this fact will often explain an apparent exception to the established rules. I do not hesitate to say, that, in my opinion, a heifer coming in in May or June, and properly treated, will be worth a great deal more as a dairy cow than one coming in with her first calf at any other season of the year.

So far as my observation has gone (and the experience of the best dairymen will coincide), a heifer coming in at two years old, — if properly fed, carefully milked, forced up, if you please, to her utmost capacity of production, and made to hold out almost till the new milk springs for a second calf, — will invariably make a better milker than one coming in at three years old. Of course this supposes that the animal, as a calf, has been well fed, and kept in a thriving condition up to the age of a year or fifteen months, when she will go to the bull. She should have a fair development and good

growth; and it is better that she should go to a small rather than a large bull. The draught on her system for the nourishment of the fœtus will be less severe than if she is fecundated by a large, over-grown bull.

Besides stimulating the mammary glands to great activity, and enlarging their capacity at this age, there is the additional advantage that the animal is more easily handled, usually more docile; she may be better managed; and she arrives at her maturity of production (which is not till after the third calf) a year earlier, so that a year is gained in her profit.

To offset these great and manifest advantages, there is the liability to some check in her growth and size, owing to the strain upon her system before it has reached its full development. This may be guarded against and counteracted by liberal and judicious feeding; and with this there will be no appreciable difference in size and thrift between such an animal and one brought in at three years old, when they reach the age of four or five.

As to the age of the bull when put to service, our theory and practice are widely different; for, while most intelligent farmers are ready to admit that one year is too young, — that the system is not mature, that the animal is not developed, and ought not to be used, — they do, in fact, use yearling bulls far more commonly than older ones. If well-fed and thrifty, we should not object to a limited use of a bull at fifteen months, and from eighteen months and onward more freely, in getting dairy stock and stock for beef. For getting working cattle, or animals for labor, the bull should be at least two years or two years and a half old. The bull is better to be worked; and, if it were our custom to use all our bulls more or less in the yoke, they would undoubtedly be all the better for it.

As to the methods to be adopted to influence the sex of the calf, a vast number of experiments have been tried, but they have usually ended in disappointment; and no law has been discovered which governs the sex. But it has been observed that the most vigorous parent will generally govern the sex; that is, that the probabilities are, that the sex will take after the stronger, more robust parent. Thus, a feeble cow, or too young a one, or one too old (past her prime), fecundated by a vigorous bull, will most generally bring a

bull calf; but the reverse will happen if the inferiority is on the side of the bull.

Thus, at the Agricultural College at Grignon, which I visited a few years ago, forty-six parturitions of young heifers with their first and second calves brought twenty-nine bulls and seventeen heifers; while twenty-eight parturitions of older cows, in their full vigor of maturity, brought eighteen females and ten males. So, at the Agricultural Institute at Hohenheim, which I also visited, a hundred and forty parturitions of young cows brought eighty males and sixty females; while older cows have always brought more females than males.

And so, if you put a cow that has recently calved, while still rather feeble, to a vigorous bull, the product will almost invariably be a male. A good dairy cow, with her strength of constitution constantly taxed, will bring more males than females, unless special pains are taken to increase her constitutional vigor by extra care and feed.

I need not stop to discuss, in this connection, the numerous points or signs which long experience has fixed upon as indications of more than ordinary dairy qualities, — such as the fine, clean head; the slender neck; the straight back; the loose or open and relaxed jointure of the spinal processes; the supple skin, with its rich and creamy color; the large development of the mammary glands, with loose, free folds when empty; the fine, clean legs; small bony structure; and freedom of offal, or waste and useless parts. Many of these signs have been known and observed for a long time.

A few years ago a Frenchman near Bordeaux, long familiar with dairy cows, and accustomed to observe and study them carefully, discovered what was thought to be a new and invaluable means of judging the quantity and the quality of milk which a cow would give, and the length of time in which she would hold out in milk.

Guénon's theory was, that the folds or convolutions of the mucous lining of the mammary glands exercise an important control over the arterial system, as manifested in the downward-growing hair of the *perinæum*, or the back part of the udder, extending from the udder, between the thighs, up to the vulva; and that there was a direct and constant relation existing between the direction of the hair in this place and

the activity of the milky glands; that the direction of the hair is subordinate to that of the arteries; that, when a large patch of hair is growing from below upwards on the *perinæum*, it proves that the arteries which supply the milky glands (which lie just behind this place) are large, and convey a large amount of blood, and so indicate great activity in these glands.

I might place it in another and perhaps clearer form, by saying that the size of the escutcheon outside is an indication of the extent of the mucous surfaces within; so that, if the escutcheon, or milk-mirror, be large and well-developed, the secreting surface within is correspondingly ample.

Guénon, in his enthusiasm, possibly carried his system too far, and claimed too much for it; but in the main it is correct, and offers an important means of judging of the qualities of the cow, in connection with other and well-recognized signs. Probably, in a large majority of cases, — perhaps in nine out of ten,— where a large and good development of the milk-mirror or escutcheon, as it is called, is united, or found in connection, with other favorable indications, — a soft skin, a fine head and limbs, and a large development of the hind-quarters, — the cow would prove to be a good milker; and the cases which were apparently exceptions might be due to some accident, or some mismanagement on the part of the keeper. I regard it, therefore, as a valuable sign, and by no means to be overlooked; but at the same time I do not believe it should be carried too far, or be depended upon without the concurrence of other good indications.

Now, in breeding dairy stock, the bull should be selected with special reference to this object. He has his fine dairy points as well as the cow; and among them is the escutcheon, which, though not so largely developed as that on the cow, is still very apparent on most bulls from good milking stock; and, where a correspondence exists between his perineal development and that of the cow, it would be so much in his favor.

With respect to the period during what is called the "heat," at which the cow should be put to the bull, no rule can be laid down upon any rational grounds. Perhaps we have too few facts in regard to the effect or influence of a service early or late in the heat. Some farmers think con-

ception is much more likely to take place if the copulation is deferred till near the end of the term; and this is a fact very generally accepted by physiologists.

There is no fixed time during which the "heat," or desire for the bull, continues in the cow: it varies according to condition, age, and many other circumstances. It may last two, three, or four days; but sometimes it ceases in twenty-four hours. In very rare cases it continues ten to fifteen days, and in some cows not more than four, five, or six hours. In some cows the length of its duration diminishes with age to such a degree, that it has been known to last only an hour. Conception always causes it to cease, and not unfrequently a copulation that is not fruitful will prevent its recurrence; but usually, if the cow does not conceive, the period of heat will return in twenty or twenty-one days.

Now, this peculiar, excited state of the cow is the moment indicated by nature for connection with the bull; and it is generally better to follow nature, and put her to the bull as soon after it appears as practicable.

Some cows will come in heat nearly every month, and it is quite difficult to get them with calf. This often occurs among high-bred cows, or cows kept too fat; but with other cows it indicates an internal scrofulous disease, commonly phthisis, or pneumonia. It is better to fat and kill or sell such obstinate cases. To stimulate heat in the cow, as well as in the bull, there is nothing better than more abundant and more nutritive feeding, with some grain, bean, or especially pea meal. Salt stimulates the appetite, and facilitates digestion; and exercise and moderate labor will also excite sexual desire. The better a cow or heifer is fed, the more intense and frequent will be the "heat" till conception takes place. If the "heat" is allowed to pass several times without satisfaction, the fecundity of the animal is injured.

Never countenance the absurd and ridiculous practices in some neighborhoods, of running a cow after copulation, or giving her a cold bath. Never cut off the end of her tail to make her "stick." All these practices are utterly absurd, — as absurd as sticking a plug of garget-root into the dewlap to cure the garget in the udder.

Many curious and interesting facts might be presented to show the importance of giving special attention to the quality

of the bull that is to go to the young heifer, as it is well known that the first impregnation will sometimes have an influence upon the progeny got by subsequent impregnations by different males. It is an influence by no means always perceptible; but it is liable to appear. This caution will apply especially to pure-bred stock, and matters less with lower-bred animals.

The opinion of Professor Agassiz on this and some other points is presented in my report of 1866, and subsequent ones. Among the many striking facts that bear upon it, I will stop to allude to only one. The Earl of Morton was desirous of obtaining a breed between the horse and the quagga, and selected a young seven-eighths Arabian mare and a fine quagga male, and the produce was a female hybrid. The same mare had afterwards a filly and then a horse-colt by a fine black Arabian horse. Both resembled the quagga in the dark lines along the back, and the stripes across the forehead and the bars across the legs. In the filly the mane was short, stiff, and upright, like that of the quagga: in the colt it was long, but so stiff as to arch upwards, and hang clear of the sides of the neck.

But not only the first impregnation, but mental impressions received by the female during the period of the œstrum, or heat, will be likely to affect the offspring, and often to a very remarkable degree. A Mr. Mustard of Angus, in Scotland, had a cow that came in heat while at pasture in a field bounded by one belonging to a neighbor, out of which an ox jumped, and went with the cow till she was brought home to the bull. The ox was white with black spots, and horned. The cow and the bull were not only hornless, but there was not a horned beast on the place, nor one with any white on it, the polled Angus breed being jet-black. But the calf in the following spring was black-and-white and horned.

A curious case is related of a Dr. Hugh Smith who was travelling in the country with a favorite female setter, when the bitch became suddenly enamoured with a mongrel cur that followed her till he was obliged, in order to separate them, to shoot the cur. The image of this sudden favorite, however, still haunted the bitch, and for some weeks after she pined excessively, and obtsinately refused intercourse with any other dog. At length she admitted the caresses of

a well-bred setter; but, when she whelped, the doctor was mortified with the sight of a litter which he perceived bore evident marks, particularly in color, of the favored cur, and they were all destroyed. The same also occurred in her future puppings: invariably the breed was tainted by the lasting impression made by the mongrel. The mental impressions received at the time of the heat are sufficient to stamp the progeny.

We cannot be too careful to select the associates we keep with our pure-bred stock.

Adjourned till Thursday, at ten A.M.

THIRD DAY.

The Board was called to order at ten o'clock by O. B. HADWEN, Esq., of Worcester, who said, Gentlemen, the subject of the lecture for the morning is "War with Insects," by Dr. JABEZ FISHER of Fitchburg, whom I have now the pleasure of introducing.

THE WAR WITH INSECTS.

BY DR. JABEZ FISHER.

The Secretary of the Board, in requesting me to meet you at this time, stated that he wanted me to give a *practical* talk about insects; he did not want me to say any thing about entomology; and the reporter expressly stipulated that I should not use any scientific terms. I will try to obey the mandate in both cases.

The principal department of the subject to which I want to call your attention is the mode of exterminating some of the various insects. That is the main point to which I propose to devote my time. I don't intend to say much of any thing that I do not know about from personal experience. I could have taken the books, and looked over a long list of matters, and told you a thousand things I do not know any thing about, and which you can find out just as easy as I can by reading, without wasting time to hear. Of course, I cannot begin and go over the whole ground. I must confine myself to some few insects with which I am most familiar.

and I shall do it in a practical way that I hope will meet your approbation.

I shall have no prescribed order; and perhaps as good a way as any to begin is to take the first insect that we shall be likely to meet in the spring, one in which most of you are interested, and doubtless have had something to do with,—the Colorado potato-beetle, or the potato-*bug*, so to speak. You undoubtedly all know him. It is not necessary to describe him. If you do not know him, you will. If you will go out next spring pretty early, you will discover him sitting around upon the fences, &c., waiting for you to plant your potatoes, or, if you have planted them, waiting for them to come up. You will certainly find him, and you will find him very early. He has crawled into the crevices and cracks with the squash-bugs, the wasps, &c.; and they are all ready for business.

I shall have very little to say about the habits of this beetle. It is an insect that has brood after brood in the same season. As soon as the young have time to hatch, you will find them at all times and stages of development during the whole season. There is, in my view, but one remedy, and that is what some of you are afraid of; but you will have to come to it,—Paris-green, arsenite of copper. I have tried two or three modes of applying Paris-green, and have settled upon one. I think the best way is to use a hundred pounds of plaster (the finer ground the better) to one pound of Paris-green. One pound is ample for a hundred pounds of plaster. I am not sure but that proportion of green is too much. Most of you have applied it very much stronger. The great point is to get a single particle of Paris-green upon the potato-leaf. Now, Paris-green is an impalpable powder: it is exceedingly fine. It is necessary to apply but a single atom of it in one spot; but you want to apply it evenly over the whole foliage of the potato; and to do it, the best diluent, the best thing to dilute it with, is plaster. I apply it by means of a dredging-box, after the form of the ordinary flour dredging-box used in the kitchen. I have one that holds about a quart, with a cover pierced with holes, which is on the end of a handle about three feet long. All that is necessary, when it is filled, is to give a slight turn to the handle, and you can apply it to the potatoes as fast as you

can walk beside a row. It is not necessary to cover the whole potato-leaf with the green; but it is better to put it on pretty thoroughly. You will find that the green colors the plaster even in this proportion, — one part to a hundred. It colors it quite distinctly, and you can see it on the potato-vine very readily. You do not want to put much on: it is a waste of the poison, and a waste of time, to do so. All you want is the slightest possible dusting; nothing more nor less than that.

I will say a word about mixing. A great many people have trouble in mixing Paris-green. They are terribly afraid of it: it is *poison*, and they do not like to handle it at all. The best way I have found is to take a large wrapping-paper (heavy brown paper), as large as you can conveniently handle, — say as large as "The Boston Journal." Your plaster should be sifted to get all the lumps out of it. Spread a layer of plaster on the paper, and then spread the green as thoroughly over it as you can carelessly; then take your paper (one end in each hand), and move it from side to side by an alternate rising and falling motion, rolling the mixture from side to side until you cannot see a particle of plaster nor a particle of green. It does not take a great while to do it. You should not take too much at a time. The quantity will depend on the size of your paper. A sheet of paper as large as "The Journal" would, perhaps, profitably use twenty pounds of plaster at a time. When it is perfectly homogeneous in color, then it is in a condition to use. The plaster will be washed off by the first rain, more or less; but the green is more persistent than most people suppose. Being a very fine, impalpable powder, it remains on the somewhat uneven surface of the foliage of the potato; after the plaster is washed off, the green is still there, and will continue to kill the larvæ of the potato-bugs that eat it. The theory of its action is, that the larva eats the green, and it must eat it in order to produce any result. It does not hurt the larva to put Paris-green upon him, it does not kill him: it must enter into his circulation to do that. One atom of the green, as I have said, will kill him, and is just as good as a pound. The same effect will be produced on any worm that eats leaves in the same way. The currant-worm and the gooseberry-worm eat the leaf in the same way: their mouth

takes both sides of it, and, wherever the green is, it will kill them the same as it does the potato-worm. You may say that it will not do to put Paris-green upon the currant or the gooseberry, because we are going to eat the fruit. I would not use it upon currants or gooseberries, except for the first crop of worms, which generally comes before the fruit has formed, or when it is very small; and ordinarily it will all be washed off the smooth skin of the berry before any of the fruit is eatable: or, if you should chance to eat any of it, the quantity would be so infinitesimal, in the way I advise its application, that no harm would be likely to arise in consequence. I should have no fear in applying it to the currant or the gooseberry *early* in the season, *before* the fruit has grown; but, after that, I should use something else.

I have one suggestion to make: I do not know that there is any thing in it, I only throw it out as a suggestion. It has come to my knowledge this year, that in four distinct cases, — in one of which there was a field of four acres, in two others a field of two acres, and in a fourth a field of one acre, — one-half of each field was treated with Paris-green. I do not know how it was spread, or how heavy the coat was: but one half of each field was treated with the green; the other half in three cases was protected by hand-picking, and in the fourth case the field was taken care of by Guinea-hens, which was a perfect protection. In all these four cases the crop, in round numbers (by estimate: it was not weighed), was double, on the part where it was hand-picked and treated with Guinea-hens, what it was on the part treated with Paris-green. I do not think the Paris-green hurt the crop: I simply call it to your attention as a point to be looked after in the future. I do not believe it is possible for an insoluble powder like Paris-green to have any detrimental influence on the growth of the potato.

I may say here, that if any of you see fit to ask any questions while a subject is up, or afterwards either, it will not trouble me at all. If I attempt to answer any question, it will be because I know something about it; and, if I do not have the knowledge, I shall not hesitate to say so. I believe Paris-green has been tried in Michigan at the rate of nine hundred pounds to the acre, without any detriment to the crop.

Mr. Brown. I will say that I put it on, and the potato-leaves were partially killed. I cannot say that that was what killed them; but I have no doubt about it, because I only applied it to a few hills, and those few hills were the only ones that were seared. The edges of the leaves looked as though they had been seared.

Dr. Fisher. I have no doubt that Paris-green will injure plant-foliage when too liberally applied; and that is the reason why I make the suggestion that you use it in the proportions of not more than one pound of Paris-green to one hundred pounds of plaster; and my experiments next year will be to increase, and even to double, the amount of plaster. There is no need of applying a large quantity of the green. The slightest possible quantity that you can get on will answer just as good practical purposes as any larger amount: therefore it is useless, and POSSIBLY dangerous, to apply any more.

Major Phinney (of Barnstable). I would like to inquire how effectually they can be destroyed upon the vine by the labor of boys, which would not cost much. It has been done to a considerable extent, I believe; the boys passing through the rows with small pieces of shingle, and destroying the bugs upon the leaf. I believe Professor Chadbourne last year recommended something to that effect, and stated that the bugs, when not more than a week old, in large fields even, with but small labor, had been destroyed by boys; one boy attending to an acre or more, and occupying but a few hours each day, and destroying them upon the vines. That has been preferred rather than run the risk of using Paris-green. There is an objection in very many sections of the State to the use of Paris-green for almost any purpose; and there is an objection in many cases to the purchase of potatoes if people know that Paris-green has been used for the purpose of destroying the bug.

Dr. Fisher. I consider that prejudice entirely absurd. We had a story last summer that the fish in the Connecticut River, which were dying in large numbers at one time, were poisoned with Paris-green that had been used in the potato-fields on the banks of the Connecticut. That comes under the head of bugs, but it is one of the *hum* species.

Question. May it not be that the plaster has as much to

do with destroying the insect as the Paris-green, by stopping up the breathing-apparatus of the insect?

Dr. FISHER. That, perhaps, would be true, if it did stop up the breathing-apparatus; which it does not. It cannot do it. If it was of the nature of oil, it would close up the breathing-pores; but no dry powder like that can have any such effect.

QUESTION. How frequently do you find it necessary to repeat the application?

Dr. FISHER. As often as you find the bug; that is to say, you go over your field, and the next day, if you have effectually applied the green, you will see scarcely any potato-bugs: within forty-eight hours every one will have disappeared. If you have not put it on effectually, if you have left spots where there are bugs, of course it will take some time for them to reach the green; but, when they do reach it, they will die, and it is only the next crop to which you are to apply it. With regard to the use of children, if it is any benefit to the children, I should use them in that way. But it is the most expensive mode possible to raise potatoes by hand-labor in picking the bugs. I have known many people who have tried it. They had a prejudice against Paris-green, and they picked faithfully and effectually every bug they found during the season: but I never knew a person to continue it two seasons; the education of one year was sufficient. The labor is altogether too much. The game is not worth the powder that it costs.

QUESTION. Is there any objection to using it in water? For two years I have simply put a teaspoonful of Paris-green in a large watering-pot of water; and it has been perfectly effectual, without injuring the potato.

Dr. FISHER. That might answer, if it did not require so much labor to carry the water. It costs so much to dilute it and carry it through a field, that it seems to me that it is not profitable to do it. Another thing: the green is not soluble in water at all. It is only by keeping it constantly stirred that you can have and hold it reasonably well mixed with the water; and you never can be sure but what one leaf is going to get ten times as much as another; and then it is very difficult to apply it so that the greater part of your water will not go upon the ground. You cannot apply it in small enough quantities. It wants simply a spray, and you

cannot readily apply it in that way. It is much easier to apply a small quantity in the dry form. There has been a machine gotten up to use as a sprinkler, costing some six dollars, which it would be a benefit to the manufacturers, no doubt, if you would purchase; but it is a waste of money, in my view.

QUESTION. I would like to ask whether the potatoes absorb any of the Paris-green as food for the plant.

DR. FISHER. Potatoes, and all other plants, absorb their food entirely in a liquid form. Paris-green does not and can not exist in a liquid form. It is an insoluble powder absolutely. As an illustration of its perfect insolubility, I may here mention a fact that has just come to my notice. A quantity of green was put in a hogshead which was nearly filled with water, to be stirred up and used, as occasion required, for potato-bugs. A valuable heifer obtained access to it, and quenched her thirst in a liberal way. The herdsman was very much frightened in consequence, and employed some hurried remedies, which proved to be of no avail; for the reason that the heifer refused to acknowledge that she had done any wrong, and never gave the slightest indication that she was in the least degree affected by the poison. If she had stirred up the green, the result would, of course, have been different. I think it is an advantage to apply the plaster when the leaves are perfectly dry. I should choose a dry, still day. The leaves come up so nearly horizontal, that they will hold the plaster perfectly. You want simply, as I said, what looks like a spray of plaster. The smallest particle of green on a potato-vine is amply sufficient for the business. It will remain there three weeks, if there should be no rain. A slight rain removes but very little of the plaster: it takes a very heavy rain to wash it all off. And the green is still more persistent than the plaster, and remains after the plaster is washed off. You cannot see it; but you know it to be there by its effects.

QUESTION. Did you ever experiment with powdered hellebore? It is perfectly efficient on currant-bushes, and does not damage the fruit at all.

DR. FISHER. That is entirely true; but it is more expensive than Paris-green, and more trouble to apply it.

QUESTION. How much more expensive?

Dr. FISHER. It costs about the same price per pound; but a pound would not go more than one-hundredth part as far as a pound of Paris-green. And another thing, a great deal of the hellebore is good for nothing; and those people who fail with it fail, perhaps, in not purchasing of honest druggists.

Mr. ——. Do you consider plaster as available in enabling the potato-leaf to retain the Paris-green as flour? In my own case, I have used a cheap grade of flour; for I thought the leaf of the potato retained the flour much longer than plaster, especially if we had rains.

Dr. FISHER. I think, that, if there came a heavy rain, your Paris-green would pretty thoroughly go off with the flour, and not remain upon the potato-leaf; while the plaster would be more likely to be washed off, leaving the green.

Mr. ——. I have been very well satisfied with using flour, because it forms a sort of paste, and sticks very well indeed.

Dr. FISHER. There is no objection to using flour at all, only, if you dilute the green as thoroughly as I recommend, it will be much more expensive than plaster, which is of itself valuable as a fertilizer. Calcined plaster will not answer at all. One application of green is sufficient for one crop of bugs only.

QUESTION. How many crops of bugs may we expect?

Dr. FISHER. You may expect to have a crop once a week, if you have good neighbors. From two to four applications in a season will be sufficient, unless the weather is very rainy.

Mr. FLINT. It is evident that everybody has more or less questions upon this point; and, if they are continued, it is apparent that the whole forenoon will be occupied on the potato-beetle. Dr. Fisher has very extensive and accurate information in regard to a great many insects that we all want to know about; and I would suggest that it would be wiser to let him finish his lecture, and then ask the questions.

Dr. FISHER. The next insect I have to notice is interesting to grape-growers. It is one that is not known by any common name; and therefore I must give the scientific name, — the *Haltica chalybea*. It is known sometimes as the steel-

blue flea-beetle. It has a most beautiful, brilliant, greenish-blue color, and a very shiny shell. It is the size of a small lady-bug, and somewhat the same shape, only a little more oval. It appears very early in the spring, before the leaves of the grape have shown; and, just about the time the buds begin to swell, the insect bores a small hole right in the side of the bud, takes out the centre, and prevents it from developing, using so much for food. They come in considerable numbers; and they pair immediately upon meeting their mates, eating what little they want, and destroying a bud every time they eat. They lay their eggs upon the foot-stalks of the leaves, or at the base of the protruding shoot, remain about for some time, and finally disappear. From the eggs that are laid are hatched small brownish, nearly black, slugs or worms, that feed upon the upper or under surface of the leaf without much choice, gradually growing with the leaves, the different broods lasting, perhaps, six weeks; when they all disappear. Sometimes they are very plenty. They have been so numerous in some private gardens as to destroy the crop completely; and any grape-grower is liable to have them over-running his vines, if he does not keep himself on the watch. It is my custom, as soon as the buds begin to swell, to go out and look, especially upon the outer rows. They do not appear to hibernate in the vineyard itself, but upon the adjoining grass-ground or other substances about. Their color is so brilliant, that you cannot mistake it with any reasonably sharp eyes; it is strongly in contrast with the brown color of the wood of the vines. It is easy to see them, and you have only to crush them with your finger to make an end of them. You can frequently kill two of them at once. If it is cool weather, it is very easy to put your finger upon them and kill them: if it is along towards the middle of a warm day, you cannot do it; for, when you put your finger where he is, he is not there, and, if you are not acquainted with his habits, you do not know where he has gone. There is a kind of magic about it. But if you have watched him before, when you put out your finger, you will see him drop towards the ground: but, just before reaching it, he frequently makes a rapid turn, and drops down one or two feet from where he appeared to be falling; and, unless your eye has followed him down in his

course quite to the ground, you can scarcely ever succeed in capturing or discovering him. In that case, the proper way is, when you come upon him, to put your left hand under him first, and then put your right finger upon him. If he drops, you have got him in your hand. If the female has succeeded in laying her eggs before you capture her, you will soon find the larvæ upon the leaves. They should be killed with the thumb and finger. I recollect one instance in which the larvæ, by estimate, destroyed half the crop of a large vineyard, because the owner did not know any thing about the insect, and did not know how to destroy it. But every insect, as was stated last evening, has its weak point. This is his weak point; and it is easy enough to sit down upon him just at that time.

One of the next insects you will find is the tent-caterpillar of the apple-tree. Very fortunately we have not seen much of it lately: in my region we have seen scarcely any. There have been only a very few, but enough, I suppose, for seed. I have no doubt that within a few years we shall see plenty of them. There is just a right time to kill them; and that is very early in the spring, just after they are hatched, before the leaves are much developed. On a sunny morning you will see the shining tent they have made, and they are pretty much all in it; and the best and most effectual remedy is the thumb and finger. No matter how filthy it appears, after you have killed one nest you cannot be any dirtier; and there is nothing that will compare with the thumb and finger for killing them. If you wait three or four days, it will take vastly more labor to get rid of them; and it is all nonsense to try to brush them off after they get big, or to take a sponge wet with kerosene or something else and set fire to the nest, because they are mostly not at home when you call. You cannot find any time in the day, when they are partially grown, that they are all at home; but, when they are quite young, you can kill every one of them by a simple motion of the thumb and finger.

The next insects that we come to in the course of the season are the borers,—the apple-tree borers especially; but the peach and quince tree borers really come under the same head, because their treatment is the same. It is necessary to know something as to the habits of these insects in order

to know where their weak points are, and so be able to attack them effectively. The apple-tree borer is the larva of an insect that lays its eggs mostly down low upon the trunk of the tree, near the ground, the latter part of June or first of July. The insects come out like a great many insects that appear in the spring, and lay their eggs. These eggs give rise to small borers, which are scarcely discernible the first part of the season. In the autumn you will see a little of the rust-colored sawdust at the base of the hole. The insect eats its way along, and crowds its castings out of the entrance of hole. He is very small at that time. If you visit the tree in September or October, with a penknife you can pick out every one of them without any difficulty. They are all superficial, very near the surface, and are very easily reached. But, if you let them remain until the next June, they are larger, and have gone a little deeper. The borers that do the most injury are the ones that live three years; and they do the most damage in the third year, of course, as they are much larger. They will sometimes completely girdle a good-sized tree by going round it, and cutting off the supply of sap. The tree will become very fruitful all at once. You wonder why you have such an enormous amount of fruit; but it is simply because its supply of nourishment has been cut off by the girdling, and the tree soon dies as a consequence.

The only remedy for this insect, like some others, is found in eternal vigilance. We must be after him at the proper season, and every time we catch him at his weak point we must kill him. A man who has an apple-orchard should go over it twice a year. If he goes in the autumn, he will take out the small ones; if he goes through in the spring, he will destroy those that have grown larger, and by the same process, — by the point of a penknife. After they get older, they bore larger holes. The third year they bore a hole upward in the tree almost perpendicular; then bore out toward the bark, and make every thing favorable, so that the coming June they are ready to come out as a perfect insect. They can only be reached, after they get to this depth, by a large amount of cutting the tree, which sometimes injures it a good deal more than the borer himself does; or else by searching for him in his hole. The directions that are commonly

given in the books are, to take a wire and run it up the hole, and you will reach him. That is very well, only the wire is not the best thing. I hold in my hand the best implement I know of: it is a small, round piece of whalebone eight or ten inches long, and so supple that it will follow the windings of a crooked hole as a wire will not. You take that in your hand, and go round your orchard and introduce it into the lower end of the hole; run it up, and, when it reaches the worm, you will hear, as you withdraw it, a sucking sound that is exceedingly agreeable to you, but I have no doubt it is unpleasant to the borer. That is always effectual. But a man who is careful will never allow the borer to get to that stage; because, if he goes round every year, they will never get large. If he neglects them, or if he undertakes to go through his orchard for the first time next spring, he will find a good many of that kind.

Then there is the rose-bug. Almost everybody knows it by that name, though it is called by another name in some parts of the State. Grape-growers have had occasion to know it the last year pretty thoroughly. It is an insect that first appears in the latter part of June. It goes through its changes in the ground. The larva does its feeding there, and it comes out in June a perfect insect which feeds upon a great variety of plants. It eats foliage of many kinds, but its especial delight is in the unopened buds of grapes. One good-sized cluster will just about make a breakfast for a pair of them, and that is rather expensive keeping. This last season they were very numerous in many places. In the eastern part of the State, I understand they were not seen. They may come there next year, and perhaps the year after they will be plenty in some other locality. Some years they have been exceedingly troublesome, and in some I have seen scarcely any. If you have a vineyard, or a single grape-vine, more or less, you will be pretty sure to find rose-bugs upon them if they are to be found anywhere. There are a few plants that they give the preference to over the grape-vine. The best trap I ever saw for them, in the way of a plant, was the blossom of the rhubarb. If any of you market-gardeners have grapes and rhubarb growing together, you will be very likely to find large numbers of them upon the stalk of rhubarb-blossoms. It is something to their taste, like the grape-

blossom, and perhaps more attractive. They last some two weeks in numbers. You will see at first a very few of them; the next day more; the next, more still; and perhaps, if there comes a very hot day, you will see enormous numbers of them. This last season I saw the most of them in this way. By the side of my vineyard I have a piece of mowing. The grass was cut one morning, and it got dry enough that day to cock up and cap. The next morning, on taking off the caps from the hay-cocks, we found great numbers of them on the under side. They were probably living upon the foliage of the grass-plants, and they did not leave while the hay was wilting; but, when it was cocked up at night, the hay was probably pretty warm, and they gradually rose to the top of the cocks, and collected on the under side of the caps. When the caps were pulled off, it being pretty warm (at first I did not notice them much) they began to fly, and went up into the air, and immediately headed for the vineyard. I do not know how they knew about it, but they all took that particular course. That was when I saw most of them, and that is where I see them every year the day after I have cut the grass near the vineyard. Well, there is only one remedy that I know of for this insect; and that is to attack them individually. It may seem like enormous labor to do it, but it is not. Any man can count a million if he will only begin and say, "One, two, three, four," and keep on; but if he never begins "One, two," he will never count a million, or any other number. My plan of proceeding is this: the first one I see I crush with the thumb and finger, and I continue to crush every one I see during the season while they last. I am at work in the vineyard all this time; and whoever is at work with me has this instruction, "Every time you see him, crush him, and stop long enough to do it." But, aside from that, as soon as they get to be a little more numerous, each person takes a little tin cup, holding perhaps a pint, with a teaspoonful of soft-soap mixed with hot water, an inch or an inch and a half deep on the bottom of the cup, and goes along holding this in his left hand; and, whenever he sees a bug, he gives him a shake, which causes him to drop into the cup that is at once his grave. Early in the morning you have to shake him pretty hard to remind him that it is time to get up; a little later in the day, he will wake up

more easily; a little later still, especially if it is quite hot, when he sees you approaching, he will fly before you get to him. His weak point is not a warm day. You must take him either in the cool of the morning or evening or during a cloudy day. At either of these seasons it is very easy to catch him. I had two boys last summer who went out each morning, and went through the two outside rows in the vineyard; and they would come back in an hour with about four hundred bugs apiece. That is all they found. Some people talk about finding them by the gill. I did not have them as thick as that. But it does not take much longer to secure a great many more; for, the thicker they are, the more you can get at a stroke. It is a very good way to have a boy go on each side of a trellis, and then they will see almost every one, if their eyes are sharp. I presume I caught in this way, in dishes, about ten thousand last year; and I suppose we killed as many more in the course of the season, as we met them. They certainly did not destroy my grape-crop, for this reason, — that I did not have much of a crop for them to destroy. The grapes were not there.

Mr. SLADE. Was the failure of the grape-crop this last year owing to an insect?

Dr. FISHER. Well, directly I can reply that it was not in my case; because, when the buds opened in the spring, the clusters of flower-buds were not there, and the rose-bugs could not have hurt them. There were only skeletons of clusters. Sometimes there were embryo buds that did not set; sometimes there were buds that set a few grapes; and there were others that set partial clusters: but on the whole premises I did not have one perfect, large cluster like those of 1877. It was not the rose-bugs. The rose-bugs hurt the two outside rows somewhat, but they certainly did not injure my crop to any extent. A great many people who did not observe carefully would go out, and, finding on their grape-vines a great many rose-bugs, when they found afterwards they had no grapes, assumed that the rose-bugs were the cause. That is a very superficial way of reasoning.

QUESTION. What was the cause of your not having a crop?

Dr. FISHER. That has nothing to do with insects, but I will stop long enough to answer it as well as I am able. My

crop evidently was not there. Why was it not there? For this reason: the grape-crop is always made the year before. My crop for 1879 is all piled up in my vineyard to-day. Every cluster and every berry that I am to have then is indicated, and is there in embryo, at this time; and next spring is simply going to develop what has been stored up, and made ready for development. Now, we must certainly go back as far as the year previous to find out what the trouble was. I think so much is certain. Well, with me, the circumstances were just these (and on these circumstances I made a little theory, and I have applied every case I have heard of to that theory, and so far they fit pretty well): the month of September, 1877, was exceedingly dry; not only was the ground parched, but for some weeks the humidity of the atmosphere had been very low. We may have either of these conditions alone, without plants suffering badly; but they both existed together in this case, and were worse about the middle of September. When the grapes were ripening, there was from a week to ten days that the berries did not color at all. The leaves were limp. The whole vineyard had a sort of heated appearance: it was evidently being starved for the want of moisture. By and by there came a little rain, and they caught up the thread of their work, and went on ripening slowly. I could tell by the show of color that they stood still for a week or ten days. They did not get water enough to amount to much of any thing until the 4th of October, which was too late to be of any use in the ripening process. I think that the buds were not matured: they were starved; and, when they opened last spring, I found this peculiarity that I never saw before: the buds would open, and grow four or five leaves, and run out at the end. They did not grow continuously, as they ordinarily do: they grew four or five leaves and then stopped, as if they had used all the material stored up the previous year, and that was all they could do. When they opened their clusters, they showed the same thing: there was starvation. There were very few berries in embryo laid up, and many of those were very weak; the set was very imperfect: and that condition continued through the whole season. And although we usually, when the crop is light, expect the berries will be very large and fine, the berries were also very small: they were starved all

the way through for the want of something they did not get the year before. That was something new to me: for I supposed, that, when they began to grow and get new sap the present season, they would make up for it; but they did not. Many clusters had stems that gained but little substance during the season. In the autumn they wilted, and the berries dropped off from the stalk very easily. This seems to me to be the explanation. To sustain this idea, I will say that the worst failure I knew this year was that of a gentleman in the same city where I live, who is on a light soil that dries up worse than mine does. Mine is very strong, deep loam, that has produced ninety bushels of corn to the acre; but his vineyard is on light land, that suffers from drought. His whole crop on three-quarters of an acre was put into a bushel-basket. My crop was about one-eighth of what I got last year in quantity. That confirms my idea. Then there are two or three other persons who grow crops on soil of the same character as mine, and they have had approximately the same results. One neighbor that I have, when I told him in September, 1877, that my berries did not appear to color, said, "Mine do, and my vines do not look as though they had been troubled for want of moisture." His evidently stood that drought better than mine; and the result was, this year he got about half a crop where I got about one-eighth. Then there is another case in the same locality, of a gentleman who has a vineyard on a flat piece of land near the river, and has standing water within four feet of the surface. His grape-vines yielded just as good a crop this year as they ever did. That goes to sustain the same theory: he had plenty of moisture to carry his crop in 1877. So far as I have heard from other places, nothing is opposed to the theory; and hence I shall hold it until it is contradicted, and no longer. If there is any gentleman here who has any facts that he can state in contradiction or confirmation of this theory, I should be glad to hear them.

Mr. Cheever. I am not a grape-culturist: I only grow for home use. I have two vines that stand in the vicinity of a sink-drain, and those two vines were the only vines that produced half a dozen bunches this year.

Dr. Fisher. Another thing. I think the pears were in the same box. I think that is the explanation of the fact

that the pear-trees last spring did not come out with blossoms. There were not many fruit-buds made the previous year, and those that were produced were not very strong. They did not set well (and there were three insects to every pear), and the fruit was not very handsome. I think the same reasoning will apply to pears as well as grapes. You will find next spring, however, that your pear-trees will be all perfectly white with blossoms; that is, I judge from my own locality, where there is scarcely a wood-bud to be found. They are nearly all fruit-buds. They have evidently not been starved for lack of water the past season.

The *curculio*. Of him I think I may say to almost anybody who does not grow stone fruits (I do not know but it is stating it rather strong), that I look upon him as an almost unmitigated blessing. I will tell you why. If it were not for the curculio, you would have such an apple-crop in bearing years, that your trees would all break down and be ruined. He is the best friend we have, in this respect; for he thins out our apples and pears wonderfully, — thins them out early, and saves us a vast amount of labor; and my feeling is that I will not disturb him. I shall let him alone.

Mr. WHITAKER. How is it when he takes the whole crop — does not thin them out, but takes the whole?

Dr. FISHER. He does not take the whole of the apple or pear crop, in my experience, in bearing years.

Mr. WHITAKER. He takes all the plums.

Dr. FISHER. He will take all the plums. I have headed him off there. I formerly planted a large number of plum-trees, but became disgusted, and took them all up.

Mr. WHITAKER. That is a *mitigated* blessing.

Dr. FISHER. Last year I planted one plum-tree in the centre of my poultry-yard; and I have no doubt I shall get some plums, and still retain the blessing for the rest of my premises. Any person desiring to grow stone fruits will find the curculio to be his greatest enemy: in fact, in the absence of any serious effort to conquer him, the crops will amount to very little. I should have no fear of defeat if that were my business; but, as I have had no special experience, it is not worth while to devote any time to it.

Then there comes the web-worm. Everybody knows him by that name. He spins a web over pears and apples during

July and August. It disfigures the tree very much, and frequently destroys the fruit; because he eats the surface of the fruits the same as the foliage, and stops their development. My plan of meeting him is the same as the others. It is a hand-to-hand contest in nearly every instance, only we do not fight individuals. In this case we destroy whole nests, the same as we do the tent-caterpillar. At that time I am engaged with my help in thinning pears; and my instruction to every person who has any thing to do with it is this, "No matter when or where you see the web-worm, no matter how high up it is, or how inaccessible, don't you do any thing else until you get that nest down." By watching the boughs carefully, and keeping on the alert, you will almost invariably get them when they are small, the same as the tent-caterpillar. They are very easy to see, — so easy, that you can scarcely help noticing them, even without looking especially for them. In the beginning they occupy only a single leaf. A whole cluster of eggs is laid upon the surface of one leaf. At that age you do not often see them. I found a few last season at that time. But before any web is spun, or when it is partially spun, and they are all marshalled in line, of course they are easily killed. You can grasp the limb that contains them, and the two or three leaves that involve the whole crop of worms are very easily taken off and trodden under foot; when, if you allow them to go on a little more extensively, it is very difficult to get rid of all of them. They are a very great blemish upon an orchard. I have seen more this year than ever before. I do not know the insect that lays the egg. I never saw it.

I will devote the rest of the time allotted to me to the codling-moth. That is one of the most important insects that we have to deal with, and one of the greatest curses — scarcely mitigated at all, as the curculio is — that the fruit-grower has to contend with. In the odd year our fruit is nearly all affected by the codling-moth. In a year like this we are under rather more favorable circumstances, because last year we only grew a small crop of fruit, and of course we raised a small crop of codling-moths. This year we obtained an enormous crop of fruit, and we got ahead of him. There was not codling-moth enough to go round; hence the large amount of smooth, clean apples that we have raised.

Many people have told me that they did not see one codling-moth; that is, there were so many perfect apples, the beauty of which took up so much of their attention, that they did not realize there was any thing else. But the codling-moth has appeared this year; and you will find he has had his share of the apples, at least one apiece. It is very seldom indeed that the insect will lay two eggs in one apple, almost never, if there are apples enough to go round; but, where there are not, I have known six eggs to be laid in one apple. The codling-moth is a very obscure insect. It is a thing that you scarcely ever see. Many people have never seen one. They have no idea what the moth is; and one reason is, that it is very small; another is, that it is a night-flyer; and another is its habit of flitting about in such a way that you can scarcely get your eyes upon it: but if you store apples in a cellar, and keep them late in the spring, you will find plenty of the moths on your cellar-windows that you can study at your leisure. I must say, that, with all my experience, I have never seen one out of doors in my life.

One great difficulty in contending with the codling-moth is, that, like the potato-beetle, it has more than one generation in one year; that is, it has two or three successive broods. The first brood of codling-moth worms come to maturity, and lay another set of eggs; and I think that the second brood also, in some cases, may lay eggs that come to perfection the same year. I am certain that there are two broods. The first one appears pretty early. I do not know exactly the date at which we find the first larvæ, but I think it is about the first of July. The insect lays an egg in the calyx of the apple or pear. The egg hatches, and the worm crawls out, a little sideways, living upon the surface of the apple until it gets to a certain stage of development, and then it goes towards the centre for the core; then it bores up the core towards the stem; and the hope of the insect is, apparently, that, in doing all that, it will cause the apple to drop. The habit of the larva is this: when it comes to maturity in the apple, it has three courses open to it; if the apple remains on the tree, the worm comes out of a hole in the side, and takes one of two courses, — it either spins a web down to the ground, which is not very common, but it can be induced to do so by a shaking of the tree, either by the wind

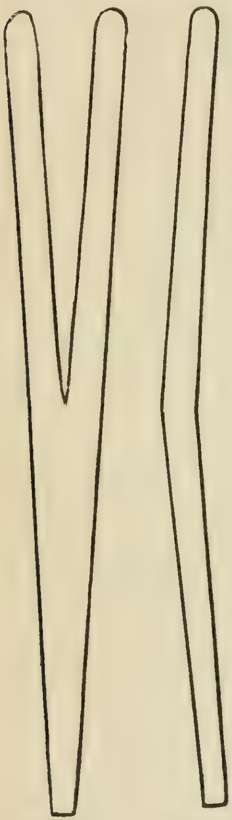
or otherwise (any artificial disturbance will cause it to spin a web, and it will let itself down to the ground); or, under other circumstances, it crawls out of the apples down the limb of the tree and down the trunk, to where the bark is loose, and finds a place there to spin its cocoon. It takes a very little space: a sixteenth of an inch is abundant for him, because he can gnaw as much as he wants to to enlarge it. If he falls to the ground by means of his web, he evidently has the faculty of seeing; because he heads directly towards the trunk, crawls up, and finds what the other has found in coming down the tree, and spins his cocoon there. Then a third way is, that the fruit, by means of his boring, has become so far weakened, that it drops from the tree. In that case the worm goes on feeding until it comes to maturity on the ground, if not already grown, and then comes out of the apple, and takes the same course that the other one did that had spun down, — crawls toward the trunk of the tree, goes up, and finds a place in which to spin his cocoon.

Now, the spot to trap him, apparently and really, is just at the trunk of the tree. My practice has been this the past year; and I have followed it very faithfully, and can give you entire results. In the first place I scrape the trunk to make it smooth, so that he will not have any chance to spin his cocoon outside of my arrangement; then I have a piece of wrapping-paper, which I fold up, and tie round the tree. I want to make as many traps for him as I can; and I fold the paper from two to three inches wide, fan fashion, and then with a string it is tied about the tree, passing round the middle of the paper. That is tied loosely with a bow-knot, so that it is very easily untied. The result is, that the worm will either crawl in among the folds of the paper, or, as he seems to prefer, the space between the inside of the paper and the bark of the tree. Here is a paper that has been used the whole season. It is ordinary thin wrapping-paper, and it would almost do for another year. I put one of these papers round the trunk of each tree that had been scraped smooth, as I said; and then I went round every Monday morning, took off the papers, and counted the moths that were in them: when I saw one, having a knife with me, I wiped it across him and killed him. They must be killed

individually: you cannot get them collectively. Then the paper was immediately re-wrapped around each tree. I applied the paper thus to fifty-seven trees in my orchard. The first larvæ were found in the papers the 22d of July. They were probably there two or three days before, but there was not one there on the 15th. I was told to apply the papers the middle of June. This was my result. I put them round at that date; but the first codling-moth was not found until July 22, and could not have been there more than six days, of course. I found at that time 76 worms or larvae; a week later I found 59; a week later, 134; then, 135; then, 344; then, 147; then, 205, 267, 222; and 274 on the 23d of September; then I did not go round until the 28th of October, at which time I supposed the season was entirely through, and I found 289, making a total of 2,152 codling-moth larvæ from fifty-seven trees. I trapped so many in that simple way. Part of my trees are in grass-land, and part in cultivated land; and I got a great many more in the cultivated ground, not, perhaps, because there were more there, but because the grass was an obstacle to them in finding the tree. I do not know, but I suspect, that, when they are in the grass, it is very difficult for them to find a tree, and they spin their cocoons in the grass. I have no doubt of it; and therefore, for this reason, the proper place to grow trees of that kind is not where you grow grass, as well as for other reasons also.

Besides this, I have been for some years in the habit of thinning all my pears; and this year, for the first time in my life, I have thinned my apples, only I did not thin them half enough; but I did take off all the imperfect ones. I thinned out upon the same principles that I do pears, and you will excuse me if I say a word about that. After the curculio has done its work (which is for me a desirable one, as I told you), I thin out a good many of the fruits when they are about the size, or before they get to the size, of an English walnut. I have made a business of thinning out all my pears for some years, and after a good deal of experience I have worked up an implement for the purpose. It is a little forked piece of steel: it is bent in a peculiar way as the result of long experience. That instrument put into the end of a long pole, like a rake-handle, is the prettiest thing that can be imagined,

for thinning pears especially. The only difficulty with apples is, that many stems of apples are so short, that it is not easy to get hold of them; but it will take a pear every time. It is carried up as close to the end of the stem as possible, given a slight turn, which breaks it off at that point, and the pear drops; or, if you choose, the pear can, with a little care, be conveyed down into your hand. It is not patented, and most any blacksmith can make it. The inside edges of the fork should be square, and it should be tempered rather soft. My instructions to the pear-thinners are these: There are four classes of pears to be removed. In the first place, where there are two or more growing in a cluster, they are to take out all but one: no matter how handsome the others may be, or how tempting it may be to let them remain, every thing is thinned out to one pear in a place. Second, every pear that is deformed, that is not going to be a perfect fruit when grown, is taken out. It is nonsense to keep your tree at work undertaking to grow imperfect fruit that will never be worth any thing. Third, every pear that shows evidence of the codling-moth is to be removed; next, all the small, weak pears — every pear that cannot keep up with its neighbors, — as Kearney says, "must go."



FRONT VIEW. SIDE VIEW.

That is severe thinning, but that is sometimes only the beginning. Having thinned out every thing that is imperfect, every thing that is in the way, then the tree is to be looked at as a whole, to judge if it is bearing more than it should. If it is, then the fruit is to be thinned out still further. That is the most difficult thing in the whole operation to do, — to thin out pears that are perfect, just as good as their neighbors; but they must come out because the tree has too many. There is no rule about this: it is a matter of education. A man must judge from his experience how

much each individual tree can carry. Mr. John J. Thomas has formulated a rule which it is perfectly safe to follow, the substance of which is this, — that no ordinary medium-sized pear should grow within six inches of another. That is a safe rule: you will not lose any money if you follow it. In many cases it ought to be ten inches instead of six.

Now, what I was coming at was this: wherever the codling-moth larva has been at work, those pears or apples, if left undisturbed, sooner or later drop upon the ground. They are worthless, but every one that has a worm in it should be at once secured. I am, therefore, in the habit of going through the orchard about twice a week, and picking off all the wormy fruits before they drop: these are kept in a basket as gathered; and, if worth feeding to hogs or other animals, I get rid of them in that way; if they are not, I have a very convenient place where I can dump them into the river, and trust, for the benefit of people who live below, the worms are prevented from transforming. That is the quickest way with me. I suppose, that, in that way, there were apples enough picked off of this same orchard to destroy a number of codling-moths equal to those I caught in the traps upon the trees, making about four thousand worms that were secured. Well, my crop was about a hundred and seventy-five barrels of good apples, generally free from the codling-moth. We found but very few when we came to pick the crop.

Now, let me ask, what will the result be to me next year? I will suppose that two thousand of the four thousand were females, and that they lay eggs to the amount of thirty each: I believe that is the ordinary estimate. I never have ascertained, and do not know; but entomologists tell us, I think, that each female lays about thirty eggs. Suppose that two thousand of them lay thirty eggs each that come to maturity, and we have sixty thousand codling-moths that I have headed off. Now, supposing that each one of those codling-moths should have gone on to maturity, and should take one apple each next year, there would be a hundred and twenty barrels of apples spoiled. If my orchard should happen to bear a hundred and twenty barrels of apples next year, I have killed just codling-moths enough to save the whole crop. Now, is it worth doing? Will it pay? That every-

body must estimate for himself. I think it does pay: I think it pays to thin apples; and it pays especially to kill all the codling-moths that you can find under any circumstances. The total cost has been not over four hours' labor a week for twelve weeks. In addition to the means here indicated, I would further suggest that an important means of preventing the increase of the codling-moth would be to cut down all the valueless cider-apple-trees in the neighborhood, which now serve only as nurseries for their development.

I have no further information to give on that point. This completes the list of out-door insects that I proposed specially to speak of.

Mr. Ware. With regard to the use of that paper around the tree, do you find that many come down from the top as far as the paper, so that you catch them on top, as well as at the bottom?

Dr. Fisher. I do not think you can tell from the result on the paper, whether they come from above or below, because they may not stop at the entrance. They may crawl about a good deal before spinning their cocoon.

Mr. Ware. Do you put that near the ground?

Dr. Fisher. I put it where it is most convenient, which is about two feet from the ground.

Mr. Ware. I will inquire, whether if the paper which is put on for the purpose of applying tar or printer's ink to catch the canker-worm was applied in July or August, it would catch the codling-moth in the same way.

Dr. Fisher. To some extent it might.

Mr. Ware. When a tree is provided with paper, why would it not be a good way to tar the paper at that time? If an orchard is provided with paper for protection against the canker-worm, why not do the same thing to protect against the codling-moth?

Dr. Fisher. There is no occasion for employing printer's ink or tar for the worms of the codling-moth. They are after a hiding-place. I think they would hide in the bark above or below, rather than go across the tar. Besides this, at the time we are trapping the codling-moth, the canker-worms are all in the ground, in the pupa stage. It is not their season.

Mr. Ware. I have observed other insects, which some-

what resemble the canker-worms, for a good many years. They crawl along the bark, and I catch them with printer's ink the same as I do the female canker-worm. But what mischief they do, or by what name they are known, I do not know.

Mr. J. S. Lewis. In my experience with canker-worms last year, I found that if they dropped off the tree to the ground, or I shook them off, or poked them off with a pole, they would crawl up again. I thought I would stop that this year, and I put a network around the tree; and the result was, I destroyed thousands of them. They could not get up. I found this fall, that, where I did that thing, there are not so many females, or so many of the males, by a great deal. There was one large tree that I could not reach at all, and the males and females are quite numerous on that.

Question. How large should a pear-tree grow in diameter before it is allowed to bear at all?

Dr. Fisher. It depends a little upon the varieties you are cultivating. My opinion is, if you are growing the Urbaniste or Dix, you may let them alone. They will not bear at all until pretty large, and then they will never bear half enough. The Bartlett, which is my principal crop, is inclined always to bear too young and too much; and that is the cause of the destruction of a great many trees.

Question. Would you allow a young tree to bear as soon as it sees fit to?

Dr. Fisher. I would not generally allow a young Bartlett tree to bear at all. If such a tree is growing well all over, you may allow it to bear a little. It is a matter of judgment. If a tree is not making wood it should not be allowed to bear, unless it has got some size. No very young tree that is growing rapidly should be allowed to bear: if it does, the fruit will not be very good. Size and vigor of tree are of vastly more value than a few specimens of fruit.

Mr. Whitaker. Would you apply the same rule in regard to thinning to the Seckel pear?

Dr. Fisher. Yes, sir, I would, and rather more so. A Seckel pear, to be of good quality, must be large.

Mr. Brown. I have upon my grape-vines an insect that

lives upon the under side of the grape-leaf. I find, when a leaf gets fairly expanded, from a score to forty or fifty of these insects upon it. They commence upon the outer edges, and work towards the stem, and destroy the whole tissue, leaving nothing but the skeleton. I resorted to picking them off by hand, and stripping off the leaves, and finally cut off my vines snug to the ground. The insect is about five-eighths of an inch long, and of a greenish color. I don't know any thing about him, except as I have seen him upon my own vines. My grapes this last year were almost covered with them, and they threaten my entire crop. If they should appear another year, I think I shall have to take up every grape-vine I have. I would like to inquire what to do about it.

Dr. FISHER. Do they stand in ranks upon the leaf, like a platoon of soldiers?

Mr. BROWN. Not always. I have seen them that way, and sometimes they are not in such good order as that.

Dr. FISHER. I was troubled with a worm of that kind some years ago; but it did not amount to any thing, so that I never gave it much attention. The remedy is perfectly obvious. Take the leaves off that they are on, and destroy them.

Mr. BROWN. I took the more comprehensive way, and just sawed the vines down. I am willing to sacrifice the few grapes I have, for the benefit of others. If you will give me any advice, I will try the experiment, whatever it may be. He is a troublesome customer, worse than any thing I have ever seen on grapes.

Dr. FISHER. After you get through with your potato-field, just sprinkle some Paris-green on the top of your leaves.

Mr. BROWN. I have tried that. I don't like Paris-green. I thought I would rather pay about fifty cents apiece for potatoes than raise them by using Paris-green. I never saw a good potato yet that was raised by Paris-green. I used it myself this year, and sold my crop for the most I could get. I don't know what the trouble is, but it is detrimental to potato-vines. I have tried it with flour and plaster. It will kill the potato-bug; there is no trouble about that: but what becomes of the potato?

QUESTION. In regard to the borer, do you think it is any use to rub soap around the bottom of the trees?

Dr. FISHER. With about half the labor that it costs to put the soap round the trees, you can kill every one of them. It is nonsense for any man to cover up his face, and try to believe that nobody can see him. I never saw an insect that would not lay its egg somewhere. If you drive it out of one place, it will go into another. The best way is to kill it wherever you find it. The habits of the quince-borer are the same, but it is not the same insect.

THE QUESTION-BOX.

For the purpose of giving an opportunity for miscellaneous questions upon farm topics not embraced in the programme, a box was provided for the reception of such questions, and a time assigned for answers to be given by experts upon the subjects to which such questions related.

The secretary read the first question as follows: —

What is the cause, and what the remedy, for rust on the leaves of Timothy-grass in the first year of its growth?

Professor W. G. FARLOW (of Cambridge). The rust on Timothy-grass is the uredo state of *Puccinia graminis*, — the same species which attacks grain. Unfortunately there is no remedy. Most European botanists think that the disease is carried to the grain or grass by the barberry, on which shrub a secondary stage of the fungus is found: consequently they advise cutting down all barberry-bushes in the vicinity of grain-fields.

The next question is, Which is the proper time to manure an asparagus-bed, — spring, or fall? How heavy a coating should be given; i.e., how many inches deep? Assigned to Capt. Moore of Concord.

Capt. MOORE. I can see no material difference between applying manure in the fall or the spring. Before a fall application, the crop of the next year is practically made: the buds are already formed, and there is root-power enough to grow the crop. You apply the manure chiefly for the future good of the bed. Eight to ten cords of partially-rotted manure is sufficient. It is more than is ordinarily used by good growers in my neighborhood; but that is not an inch deep, or any thing like it probably.

The next question is, When is the best time to trim fruit-trees? This question was assigned to Mr. Slade of Somerset.

Mr. SLADE. Fruit-trees can be pruned at any time, provided only small limbs or twigs are cut; and the rule should be, to so prune when the trees are small as never to be obliged to amputate large limbs. Cuts will heal sooner when the limbs are removed in June; but it requires more care at that time, as the bark peels so easily.

The next question is, Would it increase the yield of winter grain, rye, and wheat, to sow on gypsum? If so, how much per acre? and when, — in the autumn, or spring?

Mr. FLINT. I think I can answer that question. Gypsum is not a substance particularly adapted to promote the growth of rye or wheat. I do not believe it would pay to sow plaster on those particular crops. Plaster has its uses; but its uses are somewhat local; and the reasons why it does not do well on some soils are not well understood either by practical or scientific men. But, wherever it may be useful, it is not particularly useful on wheat, rye, or any of the small grains. That is, perhaps, a sufficient answer to that question.

It should be sown in spring always. It requires an immense amount of moisture for its solution. It is inert until it is dissolved, so that quite early in the spring is the time to apply plaster. Professor Goessmann can state more intelligently than I have why plaster is not adapted to grain-crops.

Professor GOESSMANN. Under ordinary circumstances you find that the constituents of the plaster, sulphate of lime, will not dissolve, and therefore it cannot answer directly as plant-food. It may in some instances serve a useful purpose by preparing plant-food. It is one of those chemical compounds which suffer decomposition. It liberates potash, for instance, in the soil, and therefore indirectly, in exceptional cases, it might do some good.

Mr. FLINT. The next question is, In feeding Indian-corn meal or shorts to neat-stock, is it best to do it before or after a feed of hay?

Mr. Milo J. Smith of Northampton will answer that question.

Mr. SMITH. My theory is, that all grains fed to ruminat-

ing animals should be fed after a feed of hay. If a peck of meal, for instance, is fed in the morning before hay is fed, a large portion of that goes off undigested. I suppose that one of the advantages derived from steaming feed is the fact that the meal is so thoroughly mixed with the hay, or with the cut feed: hence, if the meal, or shorts, or whatever the grain may consist of, is thoroughly mixed with the food, there is an advantage. That is my theory.

QUESTION. Would you feed it dry, or moist?

Mr. SMITH. It is better to feed it moist to milch cows. It makes more milk. I do not know that it makes more tallow.

Mr. FLINT. The next question is, Is it advisable under any and all circumstances to avoid the use of green nitrogenous manures in fertilizing grape-vines? Dr. Fisher will answer.

Dr. FISHER. Wherever your soil is very poor, you must feed them enough to grow your crops. In what I have said about the use of nitrogenous manures for grape-vines, I have presupposed that they were on good fair land; but the nitrogenous element should not predominate. The poorer your soil, the more nitrogen you may put into the field.

Mr. FLINT. Here is another question that Dr. Fisher can answer very readily now that he is up, —

Is there any wash that can be applied to the grape-vine to destroy the steel-bettle, also the worm that injures the clusters of grapes?

Dr. FISHER. No, sir.

Mr. FLINT. What is the cause of mildew on apples? and is there a preventive? I will ask Mr. Hadwen of Worcester to answer that question.

Mr. HADWEN. I do not know that I can answer the question fully. We know that mildew exists on apples, and we know that it exists on some varieties of apples more than on others. I suppose it is a fungus, and that it is stimulated by certain atmospheric influences. I know of no remedy, unless it be the universal remedy for fungi, which is sulphur. It can be easily washed off with warm water. It is a curious fact that mildew on apples and pears prevails more generally near evergreen trees.

Mr. FLINT. The next question is, Can the basket-willow

be grown to advantage in Massachusetts? If so, how, and on what soil?

That will be pretty difficult to answer in few words; but Mr. Hersey of Hingham has had experience, and can answer it intelligently.

Mr. HERSEY. I have brought some basket-willows here, and I think the willows might answer the question themselves. To answer it fully, of course, would require an hour or two. I would say, in short, that I believe it can be grown to advantage in Massachusetts. I am aware, that, during the last twenty-five years, there have been a great many efforts made to introduce its culture into the State, and nearly all of them have been failures; but those failures, I believe, have been caused by a want of the proper information. First, the right varieties of willows have not been secured; and second, when people have got the right varieties, they have not put them on the right soil, and consequently they have made a failure.

There are more than three hundred different varieties of the willow, the most of which we generally see grow on low land; and therefore, as a natural consequence, when we get a basket-willow, we jump at the conclusion that we must put it where our willows grow: so we put it on wet land, forgetting that there are some varieties of willows which flourish on wet land, while there are others which will grow only on dry land; and for some we have to go even to the tops of high mountains. Now, the variety that we must cultivate, if we hope to be successful, is what is called the *Viminalis*. The desirable basket-willow is one whose shoots will be very small at the bottom, and run up, holding the same size, to a great length. A willow that is as large as your thumb at the lower end, and tapers to a point in a length of two, three, or four feet, is of little use to the basket-manufacturer; but one which runs up like this, of substantially the same diameter for eight or ten feet, is very valuable. That is the characteristic of the *Viminalis*.

Then there is another thing about it; and that is, it is a variety which flourishes well only on warm soil. These willows which I hold in my hand were grown upon a sand-bank. You may think that strange; nevertheless, it is true. That willow, the *Viminalis*, came up by accident where good ma-

son's sand had been dug. The top of the land had been taken off entirely. Not knowing the character of the shrub when I first had it (I got it in the autumn), I packed it away in sand. In the spring I thought I took all the slips out; but I left a few cuttings, which sprouted, and for more than twenty years they have grown in that sandy land where the top had been taken off. It is true it is in a depression, where the leaves have since settled down; but they came up and grew in that clear sand, and made a good growth, as you see.

Now, do not understand me as recommending people to set their willows on clear sand. I do not desire to be so understood. If you want to be successful with the willow, get the right variety, and go on to a good, warm soil, where Indian corn will grow well. If you have a piece of land that will produce sixty or seventy bushels of corn to the acre, there you may be pretty sure of getting a good crop of the basket-willow. There is where it delights to flourish, and it will grow much larger and taller than this. But this is a pretty good length, and one which will sell well.

The amount which you can get on an acre of good land well manured, I should say, is about nine tons to the acre of the green crop. That produces about three tons of dried willow, which is worth from six to eight cents per pound. It costs something like three cents a pound to strip it by hand; but, if we get into the cultivation of it largely, we Yankees will have ingenuity enough to invent machines which will undoubtedly very much decrease the cost of stripping, and perhaps bring it down to less than a cent a pound. But even at a cost of three cents a pound, and supposing that you get not more than a ton to the acre, you will all readily see that it is a very profitable crop, simply because, when you have once manured your land and got a good crop started, the leaves which settle among these long upright shoots do not blow away, but settle down upon the ground, and there they rot; and as you all well know by observation, where there is a forest, if the fallen leaves are allowed to stay there, the land grows richer: therefore there is no necessity, year after year, of enriching your land.

Mr. Whitaker. Will it produce three tons the first year after planting?

Mr. HERSEY. No, sir: it will be about three years before you will get a large, full crop.

Mr. WHITAKER. After cutting the first year, how will the succeeding crops be, year after year?

Mr. HERSEY. The second year will be a good crop, but not so much as the third year. I do not know how long you can cut them; but I presume a hundred years, perhaps more.

Mr. WHITAKER. What is the amount that could be obtained from an acre every year?

Mr. HERSEY. I think you could get a ton a year from good land.

Mr. WHITAKER. The reason I ask the question is, I knew of the basket-willow growing in England; and the person who grew it made a practice of cutting about one-third each year, leaving the others to grow.

Mr. HERSEY. The English climate is not warm enough for this variety. I want to state one fact in regard to it, showing that our hot New-England sun is exactly adapted to the growth of this shrub, or tree, whatever you may call it. In rainy weather, when we would all suppose that a willow would make a large growth, it does not grow perceptibly; but in the hottest, sunny days, it makes more than three inches' growth a day, which shows at once that it likes warm, sunny days,—just what we in Massachusetts have, and just what I believe would make the growing of this crop a success. If those persons who first introduced this willow had understood the necessity of putting it on warm land, I think Massachusetts would now be raising more than a million dollars' worth a year. We import at the present time five hundred thousand dollars' worth a year, I suppose, or more; but if we could raise it ourselves, and cheapen its production, there is no doubt in my mind that there would be twice or three times the amount used that there is now.

Mr. FLINT. The next question is, What is the best method of manuring land for corn in order to secure the best results?

Mr. DAMON (of Wayland). Give it forty good loads of stable-manure to the acre. Spread it broadcast any time when it is convenient. Have no fear of its washing away, unless it is put on a side-hill. Any time when you can get plenty of manure, you can get a crop of corn.

Question. Would you plough it in, or cultivate it in?

Mr. Damon. I would put it in with a Randall harrow. If I put it on ploughed land, that will put it in as deep as I want it. If the ground was ploughed in the fall, I should not put on any thing but the harrow.

Mr. Flint. The next request is to name a few apples and pears that flourish on sandy or light gravelly soils. Mr. Hadwen will answer that question.

Mr. Hadwen. My experience in growing fruit on light sandy soils is not very extensive; but I know varieties of pears that have originated in sandy soils, and apparently are of better flavor when they are grown on sandy soils than when grown on clay soils. Among these are the well-known Beurre Bosc, the Lawrence, the Bloodgood, the Seckel, the Vicar of Winkfield, and the Buffum. With the Vicar, a clay soil seems to prolong the season of ripening to such an extent that it is almost always insipid. Apples do not thrive so well on sandy soils as on loamy or little stiffer soils. Still every gentleman will perhaps recall some apple-tree growing on sandy or gravelly soil, where it is well manured, that seems to produce good and well-flavored fruit. But trees growing upon a deeper soil give larger products, and perhaps, as a rule, a little more satisfactory; but there are no great obstacles to prevent gentlemen having gravelly or light soils from growing many varieties of good pears and apples, provided they make the other conditions equal.

Mr. Whitaker. How will the Porter do on sandy land?

Mr. Hadwen. The Porter will thrive on sandy land.

Mr. Whitaker. The Red Astrachan?

Mr. Hadwen. I have seen that tree do well on sandy land; and there are a great many earlier apples still, — the little old Sapson, that was cultivated in Rhode Island, and the Sweet Bough also. But for a market-crop, and for profit, as a rule, they will do better on a little stiffer soil.

Question. Is there any remedy for the cracking of the Flemish Beauty?

Mr. Hadwen. I have never been able to discover any. I cannot account satisfactorily for the cause. It would seem that it is caused by atmospheric influences to a very great extent; for, up to a certain stage, the fruit is smooth and well grown, and in a few days it is all cracked to pieces. And

then I have seen limbs on the same tree, where the fruit was perfectly smooth and good. The matter has been, and is now, a mystery to me.

Mr. Whitaker. I would state, that, when I was in Worcester County, I had Flemish Beauty trees growing on a clay subsoil which was drained previously to planting them, and I never had a cracked Flemish Beauty on that land. I left there ten years ago.

Dr. Fisher. Under the same circumstances I have them crack, — three and a half out of four.

Mr. Whitaker. Ten years ago I came to Needham, and planted the Flemish Beauty on dry, sandy land, and I have not had a good-sized, decent pear, without being cracked more or less, on that ground. The St. Michael is a pear that cracks almost everywhere ; but I have grown very good fruit on clay soil, and never succeeded with it on sandy soil.

Mr. Hadwen. The St. Michael thrives on clay soil, as a rule ; but for a good many years the St. Michael has cracked badly. Once in a while, however, we have a season when the St. Michael seems to grow as perfect as can be recollected by the older gentlemen before me, when the St. Michael was *the* pear *par excellence.*

Mr. Flint. The next question is, Can any one give the name of a red potato that excels or equals the Davis Seedling, and a white one that will take the place of the Orono in its best days ?

Mr. Perry. As to the Davis Seedling, I should say that I don't know any potato that equals it. That sells among our foreign population. It is a strong, rank potato; but it gives the best satisfaction of any potato I have ever raised. As to the other potato mentioned, I don't know what that potato is.

Mr. Flint. Another question, Why do farmers never combine their capital, buy a large tract of land, buy their tools at wholesale, hire as many overseers and as much help as is necessary, and divide the profits at stated intervals, as manufacturers do ?

Mr. Cheever. Very easily answered. Because there would be no profits to divide.

Adjourned to two o'clock.

AFTERNOON SESSION.

The Board re-assembled at two o'clock; and, before entering upon the regular programme for the afternoon, Mr. Ware described his method of dealing with the canker-worm by putting strips of tarred paper around the tree, about ten inches wide, which he fastened by a string at the top and bottom, and covered with the residuum of kerosene, in the fall and winter, when the ground is open so that the grubs come out and go up the trees, and also in the spring as soon as the ground opens.

Dr. FISHER. I think I can suggest a better remedy for the canker-worm than Mr. Ware has found. You all know what fly-paper is, and you can just as well apply that to your trees as not. I will tell you how to make it. Take linseed-oil one part, and rosin four parts: if it is too stiff, use a little more oil; if it is too limpid, a little less. That is in everybody's possession. Melt together, and apply warm.

The CHAIRMAN. The Committee of Arrangements, in arranging the programme for these meetings, were very careful to reserve the best for the last; and we have this afternoon a subject which will be interesting to all farmers, vitally so. I have the pleasure of introducing Professor STOCKBRIDGE of the Agricultural College at Amherst.

EXHAUSTION OF SOILS BY THE GROWTH OF PLANTS.

BY PROFESSOR LEVI STOCKBRIDGE.

The subject which has been assigned to me you have on your programme as "The Exhaustion of Soils by the Growth of Crops." Now, I apprehend that the expression "exhausted soil" is often used with little precision of meaning, and sometimes, perhaps, in ignorance of what constitutes the real difference between exhaustion and fertility. There is an important sense in which an exhausted soil is an impossibility. Plants are made up out of the material of the soil. Nearly all the soil, from its surface down to the bed-rock, however deep the mass may be, is capable, in answer to the action of natural law, of being transformed from the soil-form to the plant-form: therefore we cannot say that the soil is exhausted until the entire mass has passed

through this transformation. Yet we have in Massachusetts acres and acres of land which we know a hundred years ago were fertile; but to-day, although in its aggregate and in its general physical characteristics and appearance it remains as of old, it is, nevertheless, very sterile. There must, therefore, be a very marked distinction between soil in general and fertility. Mr. A. owns large areas, leagues of land; and yet he possesses nothing of which he can immediately avail himself for the production of crops. And, again, Mr. B. is the owner of a very small area; but he owns something which will enable him at once to harvest the most bountiful crops.

Now, there is a great distinction, as I have already said, between soil and fertility. The question which I am to discuss this afternoon is really this difference between these two conditions of the land; and I shall necessarily be obliged, in discussing it, to speak somewhat of the composition and organism of plants, the composition and the changes of soil by which soil is converted into plants; and then, again, I must speak of the influence of the air and of the water in producing these changes, and the influence of the general growth of plants to the same end.

First, gentlemen, the plant. To me the living plant is always a wonder; to me there is something within the living, growing plant that is a profound mystery. And yet there is an aspect of this case in which we may say the plant is as well known as the building, in its structure and in its composition, is to the mechanic who has just erected it. The seed is to me a wonder; and it is to me also, in some aspects, a profound mystery. Curious and wonderful is its formation. It is composed of two principal parts: first, the germ, which is a little plantlet, or more properly a plant in embryo, composed of roots, of stem, of bud, and of leaves. This is always surrounded by a little sack of cellular material, prepared by the parent plant as the food of the young plantlet, before its own organs are able to gather food from the element in which it is located. Now, the mystery of the thing is, that this little plantlet enclosed within the endosperm of the seed has within it the vital principle. It is alive; and, though apparently a dead thing, it will live on year after year, until there shall be a conjunction of all those

circumstances which produce germination; and then it starts into active life.

Now, we go to work, and deposit this seed in the warm, moist soil. From the water of the soil it absorbs moisture, and expands. The oxygen of the air and the warmth cause this cellular mass, which we call the endosperm, to rot. It decays, it is taken to pieces (so far as the cellular mass is concerned), and separated into its constituent parts, dissolving in water; and then circulation and growth begin by the formation of cells; expansion takes place, cell is added to cell, cell to cell, until finally the organs by which the plant can supply its own food being developed, and the endosperm exhausted, it grows on with continued additions, enlarging, expanding, sending out new organs. And, if it be an annual plant, it throws out its blossom, perfects its seed, and dies; but if it be a perennial, like the acorn for instance, it makes its annual growth, enlarging and expanding year after year, and century after century, until finally the magnificent old oak of the forest stands before us often of many tons' weight. Now, then, in both these instances, there has been a very large accumulation of matter from some source or other; but, mark you, there has been no new creation. The matter which was gathered and massed into this plant was matter as old as the morn of creation; and it has been simply passed through certain changes, been used by Nature simply to build up the organism. But what is the matter? Whence is it? Those are the questions for us to answer.

Examine, now, this plant. Take the oak, if you please, to which I have alluded. Examine it with the naked eye; examine it under the microscope: and what do you find? Nothing that you ever saw before. There is nothing in it, nothing disclosed by the most powerful microscopic lens, that you ever saw in the soil. Could it have come from the soil? No soil particles are visible; nothing that resembles the soil with which you have always been familiar. We are at a loss to know what it is. Supposing we bring in the chemist to make an examination, and he shall analyze this plant by fire, putting oxygen to work upon it, and we find by quick combustion that we have reduced it from its original condition; and now, if we were simply to weigh the ash, we should

have in our crucible two pounds in weight out of every hundred of which the oak was originally constituted. Ninety-eight parts out of every hundred have taken on an invisible form, and disappeared. We have found nothing that resembles soil.

Go a single step farther, and ask the chemist to take what we call the "ash," and apply his tests, and tell us what material it is, and whence it is. Applying his chemical tests to the ash, the chemist tells us, "Here is silica, here is potash, here is lime, soda, magnesia, phosphoric acid, sulphuric acid, chlorine, iron." We have not reached our point yet. Neither you nor I ever knew lime as lime in the soil; we never knew potash as potash in the soil. Although we are familiar with all these elements in the arts, yet we have never found them in the soil; and the question comes back, Whence this material that the plant has found which we call "ash"? And therefore we go to the soil, and see if we can find it there. A casual examination of the soil discloses this first. Here is a mass of fibrous and cellular material that seems to be in a decomposing or broken-down condition. That, we conclude at once, must be the decaying materials which have come from the former growth of plants. Further than that, we find under the microscope that this soil is made up of small, broken, sometimes rounded, sometimes angular pieces of rock, similar to the rocks which are in our fields and in the country around us, — pieces of quartz, pieces of granite, of micaceous and talcose rocks, and of limestone rocks; but still we do not find any thing like what we find in our crucible, and call it ash.

Further careful examination discloses the fact that these particles of rock of which our soil is composed are distinct minerals. Here we find talc, we find mica, we find hornblende, we find felspar, we find calcite, magnesite, apatite, and phosphorite; but we have found neither lime, nor potash, nor soda, nor magnesia, nor any thing which we find in the ash: we find simply distinct, well-known minerals. Call on the chemist again. What says he? All these minerals are distinct, well-known chemical compounds. They are not only particles of minerals which constitute rocks, but they are, away back and behind all that, distinct, well-known chemical compounds. They are a union of silica, more gen-

erally of silicic acid, with lime, potash, soda, phosphoric acid, sulphuric acid, chlorine, &c. Now, then, we find at last that in a chemical form we have in the soil precisely the same materials that we find in the ash of the plant which we burned; and it is possible that although these minerals are as indestructible as the rocks (that is just the way to put it), — although these materials are just as indestructible as the rocks, yet it is possible that this plant, somehow or other, contrived a way to draw lime, potash, and phosphoric acid out of the rocky materials of the soil. Let us, then, go back to the plant, and commence another examination.

The feeding-organs of the plant, we read, are the leaves and the roots. We will examine first the leaves. Now, this leaf is curiously and wonderfully made. First, it has a frame-work, which we call the ribs of the leaf. Through the centre, comparatively speaking, is one large timber, made of curiously-compacted fibrous material, connected with the stem of the leaf, and by the stem with the cambium of the plant from which it grows; branching out on the right hand and the left are ribs or timbers of smaller dimensions, strongly built in all directions; and over the whole, both above and below, is drawn the epidermis, or skin-cover, or coating, incasing and enclosing the frame-work of the leaf. Now, between the two, we find an open-work of cells, — cells that are cavities within the leaf, and yet are capable of holding air, gas, and water. Examining now the epidermal coating of the leaf, we find this curious fact, that every leaf is covered with a fine net-work of something which resembles hairs, and beneath that, or connected with it, a material which resembles wax, which completely, perfectly excludes from the inside of the leaf every thing solid and every thing liquid. Through that part, then, we know that nothing entered this leaf that was either in a solid or in a liquid state, because the surface of the leaf is perforated only by the most minute microscopic pores, so fine, that on a single apple-leaf there are hundreds of thousands of these little orifices entering from that to the cellular work within.

If this leaf, then, is one of the feeding-organs of the plant, — and all leaves in this respect are alike, — if this leaf is one of the feeding-organs of the plant, it has gathered nothing, it never can gather any thing, it never can feed upon any

thing, but what is in the form of a gas; and thus, as we all know, carbonic-acid gas, and perhaps carbonate of ammonia, taken through the leaf, is the food which the leaf gathers for the building-up of the plant, and which was the ninety-eight per cent of the weight of the oak-wood which disappeared when we burned it in the fire. Ninety-eight per cent, then, of the weight of the oak, to speak in general terms, was gathered by the leaf out of the air in the form of gas, and the leaf had capacity to gather and take in nothing else. Nearly all the food of the plant, then, when taken up is simply gas.

Going now to the roots, the other feeding-organs, we find here a very wonderful development. First are the trunk-roots, — large, strong, similar in many respects to the trunk of the tree or the shrub itself; but, branching out in all directions in the soil, they become smaller and smaller, attenuated until they become simply a mass of fibrous, thread-like rootlets, following the surface of the soil for a long distance around every plant, and to very great depths; permeating, winding their way through, all its interspaces, apparently clinging to the small stones within the soil, and by their numberless root-hairs taking into and clasping in their embrace all the finer particles of soil. And what are these roots doing? What are they made for? What is their capacity to gather food, if they are feeding-organs of the plant? Examine them under the microscope, and tell me what their work is, and how they perform it. Why, so far as we know, these millions of little rootlets that feed the plant are doing nothing but gathering water out of the soil: that is all they can do. There is nothing in the soil that they can do any thing with but water: it is all that they can gather.

Now, then, is it pure water that the roots gather? Nothing ever entered their portals but in the form of water. Perhaps it is a solution. Let us take the water that the roots gather from the soil, and see what it is. Apply your chemical tests to it, and it comes so near being pure water, that the most delicate tests can detect nothing, unless it is the most obscure trace of any thing, but water; and, if there is any thing there, we must boil it down before we can determine with certainty what it is. Let it alone, and the plant

will do this by root action, by capillary attraction, by osmose diffusion. I don't care by what name you call it, by some tremendous energy this water is thrown to the leaf, and there Nature boils it down. About ninety-five per cent of all the water which goes up from the root is thrown out of the leaf into the air; about five per cent remains in the leaf for the use of the plant. And in this wonderful leaf of which I have spoken now we find this union takes place: the five per cent of water and carbonic acid taken from the air unite, and by the most delicate, the most wonderful, the most mysterious processes, within the plant. With these two substances, water, and the carbon which has been taken out by the decomposition of carbonic acid, this plant will make all the organic substances, will make all the aroma of all your fruits and your flowers, will make all the gum, and all the starch, and all the sugar, and all the woody fibre which build up and make the great mass of the structure of your plants; and along with it, as it is deposited to build up the structure by the boiling-down process I have spoken of, or the reduction by throwing off the water, Nature will have deposited a little bit, the slightest possible quantity, of material taken out of the soil, and which it has carried and deposited in the plant which we find, and call "ash."

Now, then, this plant, so far as we know, has fed on two things, and only two, — the gas taken from the air by the leaf, and the water, which was the weakest possible solution, taken from the soil. There is nothing else the plant could take by either of these sets of organs; and the structure must be built up and composed of the material taken from the soil and the water by these organs in the forms I have mentioned. Now, then, if the plant did not find in the soil nor in the air the material necessary to build up its structure, and find it in the way here indicated (in the form of gas in the air, and the form of solution in the soil), the plant could not grow; and the distinctive difference between a soil fertile and a soil sterile is not that there is no lime in the soil, is not that there is no potash in the soil, because you might plant a potato-plant, which is a potash-plant, where it should send its rootlets down into felspathic sand, and it would die for the want of potash; or you might plant a wheat-plant on the soils of the Charleston basin, where it might send its rootlets directly

down into the nodular phosphoric rocks of the basin, and yet it would die for want of phosphoric acid. The grand distinction, the only distinction, between soil fertility and soil sterility, is not that there is not lime and potash and soda, and phosphoric acid and magnesia, in endless quantities, in the soil, but it is, that it is not soluble; and the distinction, the only distinction, between sterility and fertility, is solubility.

But the more important question to us, gentlemen, is, How can we make the materials for plant-growth contained in our granite soil in countless quantities, available for the use of plants? First, by the air. The air is a wonderful compound. Of course we are so familiar with the air, that we count it of little worth. It is, nevertheless, a most wonderful mixture of certain important ingredients: First, oxygen; next, nitrogen, carbonic acid, ammonia, nitric acid, ozone. That is your air. One of these elements, the gas oxygen, is one of the most wonderful in the whole arcana of nature. It is primarily the oxygen of the air which takes to pieces and destroys every thing that we know. All the monuments of man of every kind and description, — of marble, of granite, of iron, — this one simple gas in the air will sooner or later take to pieces, and crumble to dust. No power of ours, no skill of ours, will ever be able to resist its encroachments. This is the leading element in the air. The air has weight. I put it in that way for my purpose. The air has weight, and it penetrates the soil by expansion and contraction. Under the influence of daily changes of temperature the air enters the soil, and is expelled from the soil day by day, carrying in new quantities of the fertilizing elements and new quantities of the oxygen.

Now, let us see what is the result. The oxygen of the air being carried into the soil oxidizes all the minerals or metals contained in it which I have just been enumerating. It finds calcium in the soil, and changes it to lime. It finds magnesium in the soil, and changes it to magnesia. It finds sodium in the soil, and changes it to soda. It finds iron, and changes it to the oxide. All these hard, impervious, insoluble materials are thus softened and made available under the influence of oxygen. But that is not all. This oxygen finds in the soil a particle of sulphur, unites with it, and you have oil of vitriol in the soil. It finds nitrogen, and, meeting with

it in certain chemical proportions, you have nitric acid. It finds in the soil carbon, unites with it, and you have carbonic acid.

So you have made by the action of the oxygen of the air in the soil, first, oxides, and all the materials of food for the growth of your plant; and, next, you have the corroding, destroying acids, which now act in this way. Your potash, your soda, your lime, &c., which were in the soil, were more generally in the form of silicates. Lime, potash, soda, magnesia, united with silicic acid, which are as insoluble as yonder window-glass, are now touched with carbonic acid, and the lime leaves the silicic acid, and goes to the carbonic acid. The potash leaves the silicic acid, and goes to the carbonic acid, and so on; a great round of changes, each one of which wrings out of these silicates that we call the minerals of the soil, — wrings out of them lime and potash and soda, and phosphoric acid and magnesia, which we find is the material which we call "ash" in the plant, and which by this process has been changed from insolubility to solubility, and becomes available for the plant, that its structure may be built up.

But what has the plant to do with this? What has the plant to do with either sterility or fertility? Much, every way. Now, whatever the mode of action, whatever may be the power and force of the air in converting this soil from its insoluble to its soluble condition, the living plant on the soil re-enforces, strengthens, and increases it many fold. The rootlets of the living plant, working upon the surface of the particles of the soil, re-enforce and strengthen, and make more powerful, all these other natural agencies. We place the plant upon the soil. Its rootlets permeate the whole surface, clinging to the particles by the root-hairs, incasing them, holding on to them and doing what? Gathering water; making a current of water, or increasing the force of that current which passes over the particles of the soil and thus removes a solution, giving place for another portion of water to come from the soil beneath, and thus constantly keeping up a circulation of this material, removing it as formed, and depositing it in the plant above; so that the action of the oxygen and the action of the acids of the soil is re-enforced and made more active and more potent by the root-action in the soil.

This process goes on during all the season of growth: when completed, then this plant, which gathered up this material as formed, and deposited it for the time being, as it were, in a reservoir within itself, dies, and carries it all back to the soil; and thus generation after generation of plants, growing on the same land, annually gather up and deposit the material, and annually carry it back to the soil; and thus the plant exerts its influence. In Nature's processes a plant is always an enriching element. I will not stop to apply this, gentlemen. Let me repeat it to make it strong. A plant on the land, in Nature's processes, is always an enriching element, carrying back all it gathers from the soil, and carrying with it that which it took from the air, which will exert sundry influences, both physical and chemical, upon the earthy materials of the soil itself. This process goes on, I say, year after year; and here comes one of the wonders of creation. This earth has been drenched and scored and scarred, for I do not know how many tens of thousands of years, by falling water. And if He who made the soil had not provided some quality here, so that this material once prepared for the plant should be retained, this earth to-day would have been a scene of nought but desolation and sterility.

Therefore this soil, with its various properties, was made up in such a way, that when the action of the air and the action of the plant combined had developed and stored away in the plant large quantities of the proper material, and returned it to the soil, there it should remain, not washed away by the rain, not taken out of the soil and carried to the rivers and to the sea, but stored up, year after year, so that our soils become fertile, — simply magazines of proper plant-food, enough not only for one crop, but for very many crops when the circumstances of the case require us to gather plants and remove them. And thus the plant in its natural growth makes the soil richer year by year, so long as it may be permitted to continue in that condition. But, gentlemen, when man comes upon the scene, when he gathers plants from the soil that have been thus built up out of itself, and carries them away, there is an entire change of process. Every crop of plants you take from the land will carry away more material from the soil than is made by Nature in the same time. The power of the plant to gather food is

superior to all the powers of Nature to make it out of the raw soil; and, if we remove the crops, there will every year be a diminution of the store or the quantity which Nature by her efforts had laid up for the use of plants.

Now, gentlemen, I am one of those who believe — and I dare state what I believe — that we have no soil in America that is stored so full of plant-food, that we have not here a climate which will develop out of the soil plant-food so fast, that constant culture and removal will not reduce it to sterility. I do not believe that our American soils, rich as they were originally, and of which we boast as being soils of exhaustless fertility, and of which we boast that we can feed the world by our crops, — I do not believe that we have any such soils. Your river-bottoms, that grow crops continually, are yearly manured, and therefore are not included in this case. But I say we have no soils from which we can take crops year by year without reducing them to sterility, for the very reason that has been stated, — the plant feeds faster than Nature can make food for it. I know, gentlemen, you will think of England. I know you will think of that wonderful series of experiments of Messrs. Laws and Gilbert, where they tell us, that, for thirty successive years, their land has borne wheat, fourteen or sixteen bushels to the acre, on an average, without any diminution (and that is a paying crop); where they tell us that those lands for thirty odd years, without any manure, have borne them two tons and a half of hay to the acre, and for thirty odd years twenty bushels of barley to the acre. But I tell you those soils are not on this side of the Atlantic; and if that is the kind of soil they have in England, then I tell you the agricultural science of England is worth nothing to you or me. Our American soil and climate require an *American* science of agriculture. England can teach us nothing, if that is a sample of English soil.

Mr. Whitaker. That is not a sample of English soil.

Professor Stockbridge. I tell you that the science of agriculture in America is yet to be written. In my judgment, we have not any. Why? Because we have not any facts. Where are the men to-day who are gathering the facts of American agriculture by thorough, tireless, exhaustive experiments? Nowhere. Let me tell you, gentlemen of the Board of Agriculture, you never, in my judgment, will have

an American science of agriculture until you have that work going forward, painstaking, carefully, persistently, year after year. And we never shall learn how to manage our land by experiments under the foggy, damp, cold climate of England; but we must learn our facts in our bright, hot sunshine, the soil as it is, and the air as it is all around us. And we shall never be thoroughly and completely grounded where we ought to be, until we have a corps of men somewhere at work upon this all-important subject.

Now, then, I say (pardon me for this digression), that we have no soil in America that can be continually cropped, without at the same time being reduced in fertility, — growing poorer and poorer. And yet the water of the soil does not carry away appreciably any of the elements of fertility which are stored therein. Then, plants growing naturally on the soil enrich it. Plants growing on the soil by artificial culture always deplete it. We never can harvest crops from the land, and carry them away, unless, by some method or some scheme, we can contrive to develop out of the soil, by the aid of natural law, the materials we carry away, or else make direct application to the soil, in manurial form, of the materials we have removed.

But again: what is the influence of water in the process? Much, every way. And this shall close my remarks, gentlemen. Think you that the soil of Utah is sterile? We talk about "the Great American Desert." Think you that that soil is sterile? Is the soil of Colorado sterile? Why, no. It is stored, to use a common expression, "chock-full" of the proper elements for the growth of plants, in a soluble condition and ready to be used; and yet those lands produce no crops. Why? Because they have not the water; that is all. Water applied to those soils has produced the results with which we are perfectly familiar, developing the most marvellous fertility; nothing but water. Water in Colorado, on a piece of apparently barren soil, will give you thirty or forty bushels of wheat to the acre, and do it year after year for quite a number of years. Water in Utah, on those barren soils, apparently sterile, will give you most bountiful crops of all those vegetables that you put on the land. Now, then, what water can do in Utah, what water can do in Colorado. in a certain sense water can do in Massachusetts.

Have you not in old Plymouth County sandy lands which can be made fertile simply by the application of water? Certainly you have. Then the question comes, How does water act to make land more fertile? To see how water acts, I again ask your attention to the action of different kinds of plants. Plants are very peculiar in their structure and in their adaptation according to their kind or variety. Let me illustrate. I put wheat upon a given field, and grow it year after year, and year after year, until it is so nearly exhausted, that I cannot get a paying crop. It gives me five or six bushels of wheat to the acre. It does not pay, and I change it. I put on rye; and, where the wheat gave me six bushels to the acre, the rye gives me twelve, and that is a paying crop. Now, then, in their composition, rye and wheat are almost alike. The crop of twelve bushels of rye, with its straw, carried away from the land double the nitrogen, double the phosphoric acid, double the potash and lime, that the crop of wheat did. Pray tell me, how did it happen that this rye-crop got twice as much of those elements out the soil as the wheat-crop could get? It was sterile for wheat; but the rye gathered the same materials, and it gathered double the quantity. To carry the illustration farther: I cultivate the rye until I cannot get more than five or six bushels to the acre. That won't pay. Therefore I put on the same land Indian corn. Now, what is the result? Why, on the land that gave me from five to seven bushels of rye, I shall get from fifteen to twenty-five bushels of Indian corn. Indian corn, the grain and its stalk, carried away from that land, of potash, phosphoric acid, and lime, four or five times as much as the rye. The rye could not get it. How happens it that this Indian-corn plant has got so much more? I will tell you why; and that is the point in relation to water. First, I will admit that one reason why the Indian-corn plant got so much more is, that the Indian-corn plant staid on the land the longer time in the growing season; but the more important reason was this: the root-expansion of the different plants, — that is the story, — the root-expansion, and the vital power and force and energy of the roots, of the different classes of plants. Let me illustrate this by the animal world. You turn into yonder brush pasture, covered with brambles and brakes, and all sorts of

vile stuff of that kind, in which there is very little food of any value, a short-horn and a mule. The short-horn starves; the mule fats. The short-horn cannot wring out of that coarse herbage the nutrition the mule can. It is the same material in both cases; but the vital power and force and energy, the digestive action, of the one animal, wrings from the soil the nutrition fitted for both, and the short-horn starves. It is precisely so with plants. Now, then, the Indian-corn plant has a much larger root-expansion, has more vital force and energy, than either the rye or the wheat, and will gather out of that soil more of the elements of fertility; but a more important reason is, because its root-expansion pumps so much more water. The Indian-corn plant, as you know, sucks up thirty-six times its own weight of water in its season of growth, — largely more water than either wheat or rye; and this water from a larger area of soil, kept continually passing over the particles of soil, and taking off whatever solvent material it has, is carried into and deposited in the plant. Thus the Indian-corn plant can wring out of the soil by its vital energy a greater quantity of water that it causes to pass over the particles of soil than can the wheat or rye plant, and become to you a paying crop.

One step more, gentlemen, and I will relieve you. What are you going to do about it? Well, I am going to do this about it. We have in Massachusetts thousands and thousands of acres rich in the elements of plant-food. Neither we nor all who are to come after us can exhaust them. These old granite hills are rich in those materials of which plants are made. Neither we nor our descendants will ever be able to take them all out. The question is, How shall we develop them with the least possible expense to us, and with the greatest profit compared with the labor and the amount of crop we shall harvest?

First, I should say, Let the land go back to Nature. Kindly Nature will take care of it, and restore it to fertility; but we shall starve. We must grow crops that will make us food: therefore we must cultivate and carry the crops away. Now, then, I tell you, gentlemen of the Board of Agriculture, that when we know what there is in the soil, when we know what Nature is doing to develop it, and when we know what the capacity of the plant is to wring nutrition out of it,

sterility is an indication either of ignorance or of indolence; for we have no land in Massachusetts that would not, if managed with proper intelligence, and worked with a willing hand, return to us paying crops at a small cost of actual labor. I would make Nature help in the work. I would avail myself of every power and force that Nature exerts upon the soil to aid me in making plant-food in the soil, before I spend one dollar in the purchase of prepared plant-food with which to dress my land; and I would use plants as the first agent.

I have said nothing about clover. From what I say about Indian corn, you may imagine what I think of clover. I would take first, then, as an example, Indian corn on this land that will not bear more than fifteen bushels to the acre. That is a paying crop on that kind of land, because it costs nothing to till it. That crop I would harvest, carry it away, and feed it judiciously, intelligently, to the animals in my barn (and by "intelligently" I mean, to certain classes of animals), and the refuse of that crop I would give back to the land that produced it; and I would repeat the process; and then I would add to it clover, one of the best forage plants, and one of the best workers-up of the soil, that God has ever given to man. I would repeat it, I say, with Indian corn. I would then follow it with clover, spending the clover on the farm, and returning the refuse of the crop to the land; and if judiciously expended, with the right kind of stock, there would more material go back to the soil every year than was developed by Nature's process out of the soil; and by following that process, using the plant, using water wherever it can be obtained, we can make these lands bear crops as of old. But if the exigencies of the times require, if the markets of the country around us demand more, then, most assuredly, the material which we apply to the land must be the material which plants require, and in the very form in which they require it; and thus fertility will be the rule, and sterility will be the exception.

The CHAIRMAN. Gentlemen, the subject is now open. I have no doubt the professor will bear cross-questioning, or being questioned on any subject which he has not touched upon, which may be interesting to gentlemen present.

QUESTION. The professor speaks of feeding clover "intelligently" to certain animals: what kind of animals, he did not say. I would ask him to tell the members of the Board, and for my special benefit, to what class of animals he would feed his clover, that the refuse of the crop might be the best possible material to be returned to the land.

Professor STOCKBRIDGE. That is a very important question, and one which cannot be fully answered in a moment. But the point is this: plants are built up out of soil; animals are built up out of plants. If I am undertaking to renovate an exhausted farm, and do not wish to carry away any thing from the farm which has been developed out of the soil, I must not put it into an animal or into a product which I am immediately going to deport. If I undertake to make a cow or a horse on my farm, if I use my products in growing cattle, and send my cattle to Brighton, and that material is washed down the sewers of Boston to the sea, there is so much lost from my farm. If, however, I take that material, and feed it to a mature animal, — an eight-year old ox, or a four-year old sheep, — and simply make fat, which is nothing but carbon, I have carried nothing away from the farm when I deport the animal. If you would keep your clover on the farm, feed it to mature animals, and save all the manure, solid and liquid, as every judicious farmer does, and of course it will go back to your farm. Of course I know there are scores of milk-farmers here who want to know how it will affect their farms to sell milk. Sell butter; sell the carbon, which costs nothing, and which you can never exhaust, of which the supply is as limitless as the air that surrounds the globe; sell the carbon in the form of butter or in the form of fat, — and then you are robbing your farm of nothing.

Mr. WHITAKER. What would you do with your skim-milk?

Professor STOCKBRIDGE. Feed it to hogs; kill them, and sell them as fat hogs. I would buy up those hogs that they bring from the West, and fat them on skim-milk.

Mr. WHITAKER. Will skim-milk fat them?

Professor STOCKBRIDGE. Yes, sir: it is better than whole milk.

Mr. PEIRCE. If I understood the professor's remarks

right, he said that the more plants there were grown on any land, when they were not removed, the more they improved the land. If that is so, is not the clean culture that we have been brought up to believe in a wrong principle? If a man raises a crop of onions, for instance, and raises a large crop of purslane with it, although he may not get so large a crop of onions, is not his land really in a better condition than it would have been if he had killed the purslane when it was very young? That is the idea I want to suggest.

Professor STOCKBRIDGE. My opinion is, that weeds never hurt the land, but always make it better; but they do hurt the crop, and sometimes the pocket immediately. I always know that a man's *land* is improving when I go along the road and see a crop covered with weeds; but I know *he* is not improving very much.

Mr. WHITAKER. I would like to ask the professor one or two questions, and one is with reference to the experiments of Lawes & Gilbert. As I understood him, he conveyed the idea that Lawes & Gilbert have been carrying on the experiment of raising wheat on a certain piece of land for a succession of years, depending on the elements of fertility stored in the soil to supply those plants, without adding manure of any kind. Did I correctly understand him?

Professor STOCKBRIDGE. Yes, sir.

Mr. WHITAKER. I do not understand Lawes & Gilbert as having conducted those experiments in that manner, but that the experiments they have been conducting have been carried on by applying manurial constituents to the plants, feeding them, and getting crops in that way. The soils of England are as exhaustible as those of America: the difference is in the management of these soils. And, Mr. President, I will ask the indulgence of the Board a few moments, and I may say some things on that subject that will startle them a little. We are all aware that England produces a great deal less food than she consumes; that she goes out far and wide to obtain fertilizers for the purpose of producing this food. She has moved islands, I might say mountains, of guano into her soil: she once brought even the bones from Waterloo to make phosphate of lime for the purpose of replenishing her soil. You here are raising corn and raising wheat, and exhausting your soils, and sending

those products to England, and the people there are consuming them; and they take a great deal of care of the excrement, and pass that to their soil. While you are exhausting your soils, you are increasing the fertility of theirs. You are exporting beef; you are taking nitrogen, phosphoric acid, potash, and other things from your soils, and you are carrying them to England for the purpose of feeding her people, and then for the enriching of her soil. When, more than thirty years ago, I came to Massachusetts, I said, "Massachusetts farmers are the poorest farmers in the world." They asked why I made that bold assertion. I said, "They put their privies over the streams and creeks, and let the droppings run to the ocean." In other words, the farmers of Massachusetts at that time were not taking care of those elements of fertility, and giving them back to the land, as I thought they ought to do. I went to the West, and when I got there, and saw the manner in which they were wilfully wasting their soils, I said, "The farmers of the West are ten times worse than the farmers of Massachusetts: I will go back again."

There was a time when the Genesee Valley and the Shenandoah Valley were the great wheat-producing valleys of America. Are they producing wheat now? No, sir. The fertility that caused them to produce their wheat has gone to England. It should have staid here, and would, to a great extent, if we had only taken care, as we ought to have done, of the fertilizing material which came from the consumption of that wheat.

Now, the point I want to make is this: while we are talking of sending off this food material to England, and talking about the money that is coming back in the place of it, how much richer are we really making the country by doing it? We are sending the elements of fertility there. I have wondered a great many times how much real wealth we should have to boast of to-day, if all that fertility had been carried back on those lands of the West and the lands of what we now call the East, and placed in its original condition. Now, Mr. President, it may be a far-sighted matter; but I do not think it really enriches any country to export the fertility of its soil.

The Chairman. I would like to ask the gentleman how

long it will be before the country will be exhausted, under the present agricultural system.

Mr. WHITAKER. I should not want to answer that question in that way. I should say, under the present system it is already impoverished, because we are all of us to-day raising the hue and cry, "What are we to do to bring up the fertility of our soils?" We have exhausted our soil, and the wave of exhaustion has gone on from one State to another. It has found its way even to the Pacific coast, and it has been one continued system of exhaustion, until to-day the great question in all our minds is "Where can we get the fertilizing matter, and how cheap can we get it, in order to bring our lands up?" This question is now staring us in the face, and we cannot get away from it.

Mr. PERRY. Should we not add much to the fertility of the soil where it is run out, as it is on the old plains up near Springfield in the western part of the State, if we should put on crops and plough them in every year, instead of carrying them off? Would that not add to the fertility of the soil, so that we should get heavy crops in the course of a few years?

Professor STOCKBRIDGE. I am most decidedly in favor of ploughing in green crops as a means of restoring the fertility of exhausted land; but there comes up this question, "Can I not carry that same crop to my barn, and make butter out of it, which I can sell for fifty cents a pound, and then carry the same materials back at a profit?" It is a question of dollars and cents. If you will put on an Indian-corn crop and plough the crop under, you can enrich the land. If you put on a clover-crop and plough it under, you have enriched the land. The question is, Would it not be more profitable for you to carry that crop to the barn and make some product that you can sell, and from which you can put some money in your pocket, and still return to the land all the elements of fertility that you have carried away? It is a question that is to be settled by balances. Sometimes I would plough in; but ordinarily I would carry to the barn and feed. If I had land so poor that it would bear nothing but rye, I might plough that immediately in, and buckwheat I might plough immediately in; but after land gets so that it will bear Indian corn, fifteen or twenty bushels to the acre, after

it gets so that it will bear clover, fifteen hundred to three thousand pounds to the acre, I think it is better to carry the crop to the barn, feed it judiciously, and return the refuse to the land. I think there is a margin of profit between the two.

Mr. LIVERMORE. I would like to make a correction of one statement that has been made here. I was living in the Genesee Valley in the years 1851–54; and, instead of the wheat-business losing its popularity in that valley in the way which has been stated, I am knowing to the contrary, — that it was on account of the weevil. I know that at that time the farmers there turned their attention to other pursuits than the raising of their valuable wheat, simply because the weevil destroyed the crop, not because of the exhaustion of the soil. They pursued a similar course to restore the fertility of the soil to the one which has been recommended here, and that soil will be found a rich and strong soil to-day from the results of such a course as has been here recommended.

As to the exhaustion of the West, I think if the gentleman who thought there was danger of that had travelled over the Western States as extensively as I have, he would not feel any anxiety on that account. Those who have gone up and down the Missouri Valley know the depth and richness of the soil there. Those whom I questioned on the subject, who were perfectly familiar with it, agreed with me that there was fertility enough in that single valley of the Missouri River, — if developed economically, like the soils of Germany, or China, or England, — to feed the whole nation for the next hundred years. And that is but a little ribbon on the vast and exhaustless territory of the West.

In reference to the fertility of Colorado and Utah, I know that to be true which has been stated in regard to the application of water in that most desolate region to which the great Mormon prophet took his people, supposing that it was so desolate and dreary that civilization would never track them there. Those people brought water from the mountains, miles and miles away, down into that most desolate alkali plain; so that their streets now have water running in the gutters that is as pure and beautiful as you would ask to have in any of your springs at home. I have the most delicious grapes and other fruit grown in that valley, which, before the introduction of water, was perfectly sterile. The

Mormons to-day are living in a garden where once was nothing but a desolate plain.

Mr. SMITH (of Colrain). I would like to ask the gentleman from England what we should do with the surplus products of this country if we did not export them. It seems to me that it is a great blessing to the agricultural community that there is a foreign market for our products in the way of animals and grain. Of what use would it be to our Western farmers to keep the fertilizing elements at home to be returned to the soil, if they could not sell their products? It is because we have this outlet for the products of this country that we farmers can afford to buy manures, and there is enough profit remains for them to buy these fertilizers. Farmers do not care any thing about the fertility of their land, if they are unable to sell the products. What difference does it make to a farmer whether his soil is barren or fertile, if there is no demand for the crops or animals raised on his farm? The population of the United States is not sufficient at the present time to consume the grain and the meat produced in the country; and, if there is to be no export, what are we to do with those things?

Mr. WHITAKER. So far as that matter is concerned, I have nothing to say. I simply stated the fact that that was the condition of things. I do not know that we can get away from it; but it is a fact that we are sending these things abroad. The next question that comes up is, What are we getting in return for what we lay out? I said that the great question of to-day is, how to bring back the fertility of these lands. If I have made a statement which is not strictly correct, I am willing to be corrected; but if I state a fact, and somebody else is bound to butt against it, I have nothing to do with that: it is a simple fact. I don't believe any one of us can get away from it. Here is the point in a nut-shell: we cannot take the produce from the farm and send it away, either in the shape of milk or any thing else that comes from it, without reducing the fertility of that farm; and it is a question with us, how we are to keep that up. Now, the same rule will apply to the whole country that applies to the single farm. It is a question of political economy.

Adjourned to evening.

Evening Session.

The Board met at half-past seven o'clock, and the Chairman introduced Professor George L. Goodale of Cambridge as the lecturer of the evening.

RECENT RESEARCHES IN REGARD TO SEEDS.

BY PROFESSOR GEORGE L. GOODALE.

Mr. President and Gentlemen of the Board of Agriculture, — Last year I had the pleasure of presenting to this Board some notes of a careful examination of the recorded results of hybridization of plants. In the course of that lecture it was necessary to dwell with some particularity upon the phenomena of bud-reproduction and of seed-reproduction; and the differences between them were pointed out. On this occasion we are to examine, with as much care as the time permits, the changes which a ripened seed may undergo after its separation from the parent-plant. We are to investigate especially the more recent researches in regard to the germination of seeds and the determination of their value. The later researches in connection with the experiment stations in Europe and in this country have added much to our knowledge of the structure of seeds, the conditions of germination, and the detection of adulterations. In a German work[1] by Nobbe, published in 1876, the subject of seeds has been presented with care and thoroughness. The volume, although expressly designed for use and reference in Germany, ought to be translated into English, and properly annotated for employment in Great Britain and America. To the statements made by Nobbe in his treatise, the present lecture will add certain facts more recently announced, in order that the subject may be brought down to the latest possible date.

It may be necessary to give at the outset a few general principles in regard to the production of seeds, and their ripening. Many of the facts respecting reproduction of plants by seeds are known to the members of the Board; but it may be well to present them briefly in their proper rela-

[1] Handbuch der Samenkunde, von Dr. Friedrich Nobbe (Professor at Tharand). Berlin, 1876.

tions. A flower, when complete, is made up of organs which are usually grouped in two classes, — the outer, which are protective, and which often attract insects; and the inner, which are directly concerned with reproduction. The latter class of organs consists of two kinds, — the stamens and the pistil. The stamens are the male, the pistil the female organ of the flower. The stamens contain fertilizing grains of pollen, — a substance which in some flowers is dry as dust, in others more or less coherent. The pistil is composed of a hollow closed case (the ovary containing the ovules), which is surmounted by a sticky knob or line (the stigma), not unfrequently upon a slender prolongation of the ovary (the style). The ovules are minute bodies which possess at one part an embryonal vesicle, or tiny mass of protoplasm, in a compartment or cell, generally larger than the other cells of the ovule, and known by the name of embryonal sac. When, as explained last year in the lecture on hybridization, pollen of the right kind and at the proper time falls upon the stigma, it sends down, sooner or later, a microscopic tube, which makes its way to the embryonal sac of the ovule. As a result of the contact, a series of changes begins in the embryonal vesicle. The changes which are thus initiated by the pollen may go on to completeness in the formation of a ripe, sound seed; but the changes may stop far short of this, in which case an imperfect seed must necessarily result. At the time of or shortly after fertilization of the embryonal vesicle, certain changes take place also in the ovary, and sometimes in the surrounding parts. The fertilized ovary, often with adhering parts which have become likewise modified, becomes the fruit.

If the fruit ripens with only one seed within, it may so closely resemble a seed in its appearance, that it may be mistaken for one, and called a seed. For instance, the seeds of wheat and the other cereals, of buckwheat, beet, sunflower, parsnip, and carrot, are all contained in fruits, or ripened ovaries; and, although such are cases of true fruits, they are popularly termed seeds, and are generally so denominated in treatises upon agricultural seeds.

A seed consists of its own integuments, or coats, and a nucleus, or kernel. The integuments differ greatly in texture in seeds of different plants, and somewhat, as will be seen farther on, in seeds of the same kind.

The nucleus comprises the embryo, or germ, and its store of food for the early days of germination. In the seeds of many plants this store of food is incorporated with the germ; for instance, pease, beans, and squashes have the food in the substance of the embryo, forming one body with it. In corn, wheat, and the other cereals, the germ occupies a small space at the lower part and at one side; while on the other sides of the germ, and above it, the food makes up the bulk of the grain. The germ of a seed is a rudimentary plant having a leaf or leaves, and stem, which are extremely reduced in size, and frequently much disguised in shape. The amount and character of the food within the seed, and the stage of development of the germ, depend, of course, upon the degree of maturity.

Under the microscope a seed is seen to be made up of cells or minute compartments, which are arranged in an orderly manner, and which have various contents. The most important of these to be now mentioned are starch and proteine matters. The starch exists as minute grains, having general resemblances of shape in seeds of the same kind. The shapes and some other characters are so nearly constant that they enable an expert to identify the kinds of starch from different sources. Frequently associated in small amount with starch, but often replacing it altogether, there are solid fats or oils, concerning which nothing further need now be said. The proteine, or nitrogenous, substance in seeds, constitutes the material out of which the living matter in the plantlet, the protoplasm, is to be constructed. Considered, therefore, microscopically, a seed is a structure made up of closed compartments, some of which contain materials like starch, to be used in building, and proteine matters, which are to become protoplasm.

Without dwelling upon the chemical composition of seeds, attention may be called to the fact that a seed represents in its constitution a certain amount of treasured force, or "energy of position." It represents in its oxidizable substances a definite work performed by the plant on which it ripened: this may be likened to a weight which has been, by the expenditure of force, elevated to a given height, and which, by virtue of its position, is capable, when released, of performing in its descent a certain amount of work; or it

may be better said to be the potential energy inherent in many chemical substances. The treasured energy in the seed represents the sunlight of the summer in which the seed ripened: it is a potential energy, which becomes actual during germination. For its release, it requires moisture, oxygen, and a definite temperature: when these conditions conspire, changes take place in the chemical composition, the microscopical characters, and the form of the embryo. Moisture is absorbed, oxygen also is taken in, and carbon-dioxide is evolved, the solid food is gradually changed into a liquid form in which it can be used, new cells are constructed, and new parts are built up. The germ is so far extricated that it can develop into a plantlet with green leaves, and, when their activity is established so that the plant can transform inorganic matters into organized substance, the period of germination is finished. The elementary facts just presented constitute an introduction to the recent researches relative to seeds and their germination.

1. *The Absorption of Water by Seeds.*

The amount absorbed before germination begins varies in different seeds, as the following table shows. The first column is by Hoffmann,[1] the second is from Nobbe.[2]

SEED.	Per cent of Water absorbed compared with Weight of Seed.	
Wheat	45.5	60
Corn	44	39.8
Pease	106.8	{ 96 71
White clover	126.7	89
Red clover	117.5	105.3

The seeds of leguminous plants absorb a much larger amount of water than do the cereals. F. Tschaplowitz[3] ascertained the amount of water absorbed by different seeds (of pease, barley, wheat, and rye) before their germination to be much greater in the case of the small than the large

[1] Hoffmann, Landwirths. Vers.-Stationen VII. 47.

[2] Samenkunde, 119.

[3] Wassergehalt und Quellungswasser einiger Samen, — Landwirth. Versuchs-Stat. 1876, 412.

seeds, and to be, in general, much less in seeds which germinate early. It is well known, that, at the outset of germination, there is a slight elevation of temperature of the seed, which has been attributed to the commencing oxidation of food-substances. This was shown, however, by Wiesner[1] to be connected with the forcible absorption of water, and to be plainly observed before the evolution of carbon-dioxide. But, although liquid water is forcibly absorbed by seeds and with elevation of temperature, there is some reason for believing that water in a state of vapor is not absorbed by them at all.[2]

The absorption of water is correlated with the absorption of oxygen, and with the temperature. Cœlestin Hermanauz[3] has shown that access of atmospheric oxygen and water, both of them essential to germination, stand in a certain sense opposed to each other; and, furthermore, the absorption of water is much hindered by a low temperature. Lastly, according to the same experimenter, the capability of germinating at all diminishes with increase of time required by seeds for the absorption of water. Certain interesting experiments in regard to the slow germination of seeds with hard integuments, and as to the possibility of hastening this by incisions, must be passed by without further notice. The most valuable recent contribution to this part of the subject is by Nobbe[4] and Haenlein, who have carefully examined the integuments of certain seeds with reference to their resistance to external influences which induce germination. The results of their investigation in regard to red clover may be briefly summarized as follows: The coats of the seed possess five distinguishable layers, which behave differently in regard to water, and which vary considerably in different seeds. The seat of the resistance is not, as Nobbe himself formerly supposed, to be found except in the more superficial layers. The percentage of "hard" or resisting seeds was found to be, in *Trifolium pratense* (red clover),

[1] Wien-Sitzungsb. LXIV. 1871.

[2] F. Haberlandt. Wissenschaftl. praktische Unters. auf dem Gebiete der Pflanzenbaues. Vienna, 1, 63.

[3] Biedermann's Centralblatt für Agricult.-Chemie. 1876. Bd. 10, 357.

[4] Die Landwirthsch. Versuchs-Stat. xx. 11 (1877), p. 7.

	Maximum.	Minimum.	Average.
1872	15.50	3.75	8.93
1873	22	1	8.76
1874	24.50	.50	8.18
1875	19	4.50	10.32
1876	14	.25	7.41

2. *The Absorption of Oxygen during Germination.*

Concerning this, little is to be added as the result of recent researches. That oxygen is absolutely necessary to the beginning of germination has been long known. The amounts of oxygen consumed during the early stages of the process are given in the following table by J. Wiesner,[1] in which the percentages of carbon-dioxide evolved furnish data for an easy calculation.

100 grams of dried substance yielded of Co_2—

In 1–5 hours	0.000
9–23	3.179 radicle visible.
24–31	4.963 radicle 2–10 mm. long.
32–49	9.565 radicle 10–20 mm. long.
49–58	12.381
58–79	15.170
79–126	21.305
126–132	0.000
	66.564 Co_2.

Nothing of importance has of late been added to the relation of depth of planting to access of atmospheric oxygen.[2]

3. *The Temperature requisite for Germination.*

The approximate figures given by Professor Sachs[3] are under three heads,—the minimum, the maximum, and the optimum or best temperature; for convenience of reference they are here reduced to Fahrenheit's scale.

1 Quoted by Nobbe, Samenkunde, p. 172.

2 Certain interesting experiments in regard to the retarding effects of pure oxygen upon germination cannot now be described in detail. It is sufficient to state that the percentage of oxygen in admixture in the atmosphere is not far from that actually determined to be the very best for germination.

3 These experiments were reported in 1861, the later series in 1865.

	Minimum.	Optimum.	Maximum.
Indian corn	49	91.4	114.8
Bean	49	91.4	114.8
Pumpkin	51.8	91.4	114.8
Wheat	41	84.2	107.6
Barley	41	84.2	100.4

A later series of experiments by Professor Sachs showed conclusively that the minimum temperatures in the above table are too high. Many observations have lately been made, notably those by Uloth[1] and Kerner,[2] by which it appears that the seeds of many plants can germinate at a temperature slightly above that of melting ice. The repeated examinations lately made in testing seeds indicate that the most favorable temperature for the germination of the seeds of most agricultural plants is to be found between the figures given above in the optimum column.

The conditions which have now been briefly referred to as essential to germination at all are moisture, warmth, and oxygen; and incidental reference has been made to the amount of moisture, the degree of temperature, and the percentage of oxygen, ascertained to be best for rapid and healthy germination. We pass next to a consideration of a few conditions of normal germination which are dependent, not on the surroundings of the seed, but upon the seed itself.

1. *The Degree of Maturity of Seeds.*

Without devoting too much space to the present views respecting the influence of ripeness upon germination, the results of two experimenters may be stated.[3]

Nowacki, at the close of a long series of observations upon the maturity of wheat, concludes that yellow-ripeness is the best stage; and with this view many practical writers quoted by Nobbe agree. The observations of Nobbe himself upon the germinative capacity of ripe and unripe seeds of conifers are instructive. In nearly every case there was distinctly evident that a *mean* ripeness, which is between a too early

[1] Uloth, Flora, 1871, No. 12.
[2] Botan.-Zeitung, 1873, 437.
[3] See Appendix for notes of early views respecting the requisite degree of maturity of seeds.

and a too late gathering of the seed, is best; and there was also obvious in most instances a subsequent ripening in the cone; just as, in Nowacki's observations, there was noticed a marked ripening of wheat in the ear after its removal from the plant. During the last few years nothing of value has been added to the relation of immaturity of seeds to precocity of the plants produced by them.

2. *The Vitality of Seeds.*

Concerning the length of time during which seeds of different reeds can preserve their germinative power, little has been contributed of late. It may, however, be worth while to glance at the account of "mummy wheat," which is reproduced in the newspapers with a greater degree of regularity than the story warrants. As usually stated in the journals, a scientific man in Germany took from the hand of a mummy, at the moment when the wrappings were removed, a considerable quantity of wheat, which he was able to make germinate; and thus, after a period of thousands of years, the grains produced good plants. A careful examination of the literature of the subject shows that the story is probably based upon the following facts, which are given in a botanical journal for 1835:[1] —

"On Friday, Sept. 19, 1834, at the first session, the president opened the meeting by an account of the germination of some wheat-grains taken from Egyptian mummies.

"In the year 1833 Count von Sternberg received from Lieut. Prokesch of Osten some wheat-grains found in the wrappings of Egyptian mummies. The first attempt to vivify the grains, namely, by means of acid, miscarried, probably owing to the action of the acid on the starch, causing it to dissolve.

"Pure water acted in the same way. Next the grains were dipped in oil, then planted pretty deep in a pot of earth, and the latter placed in a vessel of water. Two seedlings came up. The fruit turned out to be, "*Triticum vulgare, spica laxa, mutica, alba, glabra, Metzger.*

"Dr. Zollikofer of St. Salle remarked that Dr. Gay of Paris, some years ago, had published a short paper on similar researches."

I have been unable to find the publication of Dr. Gay which is referred to in the last sentence of the quotation. Concerning the statement made by the distinguished presi-

[1] Flora, 1835, i. p. 3. Report of the meeting of Bot. Sect. Germ. Phys. and Nat.

dent of the section, it must be observed that the wheat was not obtained by the experimenter from the wrappings of a mummy, but had been transmitted by a second person, and thus there is left room for a most reasonable doubt, more particularly when it is remembered that it would require no very expert jugglery to effect an interchange of grain under the very eyes of an observer. Moreover, it is an unquestioned fact, that the grains which are found in the wrappings of the mummies of Egypt have become blackened as if by slow charring, and, in every recent instance in which the dark grains have been planted, they have failed to start. The grains of maize found with the mummies of Peru, and which are exhibited at the Museum of Archæology in Cambridge, are likewise darkened, and they have uniformly failed to germinate. The instance of "mummy wheat" has been alluded to because the question is often asked upon what ground the story is based.

But, in spite of general incredulity among botanists in regard to the vitality of "mummy wheat," some facts are on record which will serve to show that the seeds of certain plants preserve their germinative power for a very long period. In the Appendix[1] will be found three cases which are not generally referred to in popular treatises upon vegetable physiology. The two reviews now to be given are very instructive, and are perfectly trustworthy.

DeCandolle[2] gives an account of his experiments with three hundred and sixty-eight species of seeds which were kept in the same place, and as nearly as possible under the same conditions, for fifteen years.

Of 10 Malvaceæ	5 came up, or 50 per cent.				
45 Leguminosæ	9	"	"	or 20	"
30 Labiatæ	1	"	"	or 1	"
10 Scrophulariaceæ	0	"	"		
10 Umbelliferæ	0	"	"		
16 Caryophyllaceæ	0	"	"		
32 Gramineæ	0	"	"		
34 Cruciferæ	0	"	"		
45 Compositæ	0	"	"		
1 Balsaminaceæ	1	"	"		

A report of a committee of the British Association for

[1] Appendix ii. [2] Annales Sc. Nat. 3 ser. 6, 373.

the Advancement of Science, consisting of Mr. Strickland, Professors Daubeny, Henslow, and Lindley, was made in 1850, after a very prolonged and careful investigation. They found that seeds of *Colutea* germinated after forty-three years, and of *Coronilla* after forty-two years. They ascertained that seeds of twenty genera germinated after from twenty to twenty-nine years, — *Croton*, *Malva*, *Hibiscus*, *Sida*, *Corchorus*, *Triumfetta*, *Pultenæa*, *Crotalaria*, *Galega*, *Clitoria*, *Æschynomene*, *Hedysarum*, *Phaseolus*, *Dolichos*, *Cassia*, *Cæsalpinia*, *Tamarindus*, *Adenanthera*, *Cryptandra*, *Eucalyptus*. And the following preserved their vitality from ten to nineteen years, — *Allium*, *Camassia*, *Pinus*, *Cucurbita*, *Lupinus*, *Galega*, *Cassia*, *Oxyura*, *Œnothera*, *Clarkia*, ten genera, two of which were mentioned in the other list.

Many interesting observations have been made during the last few years relative to the best conditions for preserving the vitality of seeds unimpaired. As might naturally be expected, the conclusions agree in recommending that the seeds be kept without access of air, and in a moderately cool place. Under these circumstances a slight amount of moisture does not appear to be injurious; and it is probably on this account that *ensilage*, or the burial of wheat in mass deeply in soil where it cannot obtain sufficient oxygen for germination, has been proposed. G. Thurel[1] has shown that the seeds of many kinds of plants can be preserved for at least thirteen months under sea-water. Only two of these are of agricultural interest, — medick and beet, and one plant of the garden, celery.

Besides the two considerations just mentioned, which greatly affect the vitality and the worth of seeds, namely, ripeness and freshness, we must mention one which is often overlooked. Inherited vigor is a very important factor. Last year I brought to the notice of this Board some of the recorded observations in regard to the sterility of plants. We then had occasion to observe that ovules may, in certain cases, be so imperfectly fertilized as to form no embryo capable of developing. In some of these instances the seeds may attain a moderately large size, or may even resemble good seeds in their external appearance; but the germ is practically left out. These worthless sorts are

[1] Biedermann's Centralblatt, 1876, Bd. 10, 154.

spoken of by Nägeli[1] as follows: "A third degree (of partial sterility) is characterized by small, imperfect fruit, and empty seeds; a fourth degree is marked by ordinary fruit, and empty seeds: a fifth, by normal fruit, and apparently good seeds which have no embryo; a sixth yields normal fruit, with seeds having a minute, imperfect embryo, incapable of germination." Here are four sorts of good-for-nothing seeds which might readily deceive. Of course the degrees are very arbitrarily marked; but they serve to show, that, so far as external appearance goes, there are bad seeds which might easily be mistaken for good ones. The causes of such imperfect fertilization are numerous; but their consideration would take us too far out of our present line of thought: it is enough now to call attention to the fact that there are seeds, which, though apparently good, are, through lack of a germ, far worse than useless. Their false appearance of goodness is so deceptive, that it might ordinarily escape detection. The detection of these extreme cases is possible, and will be treated of in the last part of the present hour. When we speak of the estimation of the value of seeds, it must not be forgotten that seeds from the same plant may differ in inherited vigor in all degrees, or very widely.

3. *Soundness.*

How far can a seed be injured by mechanical, physical, or chemical agents, without being thereby killed, or even so far impaired in vigor as to be undesirable for planting? The practical bearings of this interesting question are very obvious. The inquiry has reference to depredations by insects, and to the use of chemicals for the purpose of destroying fungi in the coats of seeds.

After Mechanical Injury.—Van Tieghem has published an interesting account of certain researches made by him in regard to the mutilation of seeds, by which it appears that it is possible to cut the germ of sunflower, for instance, into separate parts, which will grow for a while, and which will attain a considerable size. A vertical section divides a plantlet into two lateral halves: each of these will grow, and

[1] Bastardbildung im Pflanzenreiche. Sitzungsb. der Math.-phys. Classe, Königl. Akad. Münch. 1865, Dec. 15.

produce a plant, but with much impaired vigor. Moreover, in other experiments the food in the seed-like fruit of "four-o-clock," a garden-plant, was removed carefully, and replaced by other starch, which the plant used almost as readily as the uninjured ones did their own store of nourishment. These striking experiments have been repeated, with more or less success, at the Bussey Institution, by Mr. B. M. Watson, jun. Similar observations have been made by Thaddäus Blociszewski,[1] of whose results the following synopsis is made:—

1. The cotyledons of *Pisum sativum* (pea) and *Lupinus luteus* (lupine) were severed from the radicle, and planted in earth, and on moist paper. At the point of separation they formed good roots, but no plantlet.

If one cotyledon was left on, the plantlet was produced about as soon, and as large, as in the case of uninjured seeds.

Rye embryos separated from the food perished at once; but if they were cut vertically, and were allowed to use the half food remaining, they thrived.

Rye embryos did pretty well when separated from their own endosperm, if they had access to a mixture of starch, sugar, and asparagin.

Injury produced by Physical Agents.—From the vast amount of material respecting this subject, a selection has been made from Professor Just's contribution in Cohn's Beiträge, 1877. It will be seen that the synopsis touches some other points already alluded to.

1. There is no fixed maximum temperature for the germination of the seed of any species. There are slight fluctuations according to the peculiarities of individual seeds.

2. By the action of a maximum temperature during germination, seeds suffer injury, which is expressed by an increase of the time required for germination to begin, as well as by a more tardy development of the germ.

3. Sound seeds under normal favorable conditions for germination start unequally; that is to say, a small number will start precociously, then the number rises rapidly until it reaches a maximum, then gradually falls to the lowest point, or zero.

4. Seeds of the same species lose their vitality under the

[1] Landw. Jahrbücher, 1876, 145-161.

same external conditions at different times, dependent upon the individual peculiarity of the seed.

Saturated air and a moderately high temperature cause an impairment of the vitality.

5. In a saturated atmosphere seeds will not germinate at a constant temperature high enough to keep the vapor from depositing on the seed.

6. Upon loss of water of constitution many seeds are spoiled.

7. Upon access of water, the action of a high temperature, and *lack* of air, seeds are at once irreparably injured.

12. If seeds are not killed by boiling water, their immunity results from their peculiar coats.

13. The unfavorable effects produced by too high temperatures are almost exactly like those produced by too great age.

14. High temperatures injure in the following ways: —

1st, Germination is retarded.

2d, Development is slower.

3d, Percentage of viable seeds is smaller.

15. The killing of seeds at too high temperatures has nothing to do with the coagulation of albumen.

To show that cold has little effect upon wheat-grains, the following extract from "The Gardener's Chronicle"[1] is instructive: —

"Dr. Schomburgk narrates, in his report on the Adelaide Botanic Gardens, that he received a sample of wheat taken from a quantity left by the American arctic expedition ship 'Polaris' in 1871, which had been abandoned in north latitude 81° 16′. The wheat had been left on the beach, exposed to the snow and a temperature of 72° – 104° of *frost*, for five years, and was found in a heap by Dr. Ninnis of her Majesty's ship 'Discovery' on the return of the last arctic expedition to England. Dr. Schomburgk sowed about three hundred, of which sixty germinated. The plants grew healthy, and reached to the height of from three to four feet."

The Action of Chemical Agents upon Seeds. — The early researches by Humboldt and others, in regard to the use of dilute chlorine-water for the purpose of hastening germination of seeds, have been so often described in works accessible to members of the Board, that they will not now be further alluded to. Moreover, the reputed value of camphor-

[1] Gard. Chron., London, Aug. 10, 1878, p. 183.

water to increase the germinative vigor of seeds, about which much has been written of late, will not now be discussed, but simply dismissed with the statement that the latest researches do not support the claims previously advanced for this agent. The results have generally been negative and unsatisfactory.

No presentation of the subject of the action of chemical agents upon germinative power, or upon seeds in general, can be complete without copious references to the investigations by Cary Lea of Philadelphia; but at this time I can only hope to give the results of later studies, and chiefly with reference to the destruction of fungi upon seeds. In the work of Nobbe, to which so many references have been made during this lecture, will be found a list of more than a hundred chemical substances which have been employed to prepare seeds for planting. Of these only chlorine-water, — which, in a very dilute state, appears to hasten the process of germination, and not very unmistakably, either, — and dilute solutions of blue vitriol, or sulphate of copper (to destroy smut and the like), have a creditable record. To the general statement that dilute solutions of sulphate of copper do not much impair the vitality of seeds, while in some cases they appear to be efficacious in destroying the fungus, may be added two recent observations not given in Nobbe: —

1. Kudelka[1] placed two packages of three hundred grains of wheat under different treatment, as follows: the grains in one package were soaked for sixteen hours in half-per-cent solution of blue vitriol, the grains of the other in distilled water, and they were then made to germinate in sets of one hundred in the testing apparatus of Nobbe (to be by and by described), — one hundred in earth half a centimeter, or one-fifth inch, deep; and one hundred in earth a little over an inch deep.

	Germinated.	
	In Water.	In one-half per cent Solution.
In the testing apparatus	74	66
In earth ½ cm. deep	67	65
In earth 3 cm. deep	54	24

[1] Biedermann's Centralblatt, 1876, 10–192.

2. Isidore-Pierre[1] obtained almost identical results, and ascertained, that, with a two-per-cent solution at 140° Fahrenheit, the germinative power was retained by fifty-four per cent of the seeds; at 122° Fahrenheit, by sixty-three per cent of the seeds.

As will be seen, even from the brief presentation of views now given, the conditions of healthful germination belong to two great classes: 1st, Those which depend on the seed,— namely, ripeness, freshness, and soundness, together with inherited vigor of race; and, 2d, Those which depend on the surroundings, to wit,—moisture, warmth, and oxygen. With a due regard to these conditions, and with a knowledge of the peculiar management required by certain seeds, almost all elements of uncertainty are removed, so far as the mere matter of germination is concerned. But there are many undetermined questions which are now attracting attention, respecting seeds, and which cannot be satisfactorily answered at the present time. Prominent among these questions I will mention only two: 1st, The action of the so-called chemical fertilizers upon germination; and, 2d, The effect of temporarily arresting germination. These questions, together with the less practical, but no less important, ones of the changes which the food undergoes in the seed during its ripening, during its resting state, and during its germination, are being diligently studied by many investigators. It would be, perhaps, worth our while to deal with these matters, if we could have two hours for our present task, instead of one; and I must therefore reluctantly pass by the researches of Borodin, Pfeffer, and others, without notice, and proceed to the consideration of seed-testing.

SEED-TESTING.

Although the examination of samples of seeds for the purpose of determining their value is not a new thing, it is only within a few years that it has been managed on a large scale and in a systematic manner. In the present account will be given certain facts respecting the routine of methods now employed at Tharand at the Experiment and Seed-control Station, together with a brief description of the results obtained at the Experiment Station in Connecticut, and by Professor Beal in Michigan.

[1] Biedermann's Centralblatt, 1876, 10-362.

1. The object aimed at in seed-testing is the determination of the degree of genuineness, purity, and soundness of average samples. The examination, if thorough, should afford a fair basis upon which an opinion of the commercial value of the seeds may be reasonably based. It is to be observed at the very outset, however, that there are certain possible sources of error in such examinations; for instance, the samples may not fairly represent the bulk of the seed; but the chances for doubt as to the validity of the estimates will be diminished in number as the methods become more familiar.

The selection of the sample must be made with great care. In large lots of seeds, the samples must represent thorough mixtures of the bulk; otherwise any examination would be liable to unfairness, and surely lead to prejudices against the process of testing.

The weights of samples recommended at Tharand are as follows: —

For white clover and the fodder grasses . .	50 grams
red clover, buckwheat	100 "
the larger seeds	250 "

which may be closely enough represented by two, four, and eight ounces respectively, as has been done by the Connecticut Station.

The Estimation of the Genuineness and Purity. — This must be by a careful examination, under a lens, of small amounts, say of one hundred or two hundred seeds, taken from different parts of the sample. Specimen sets of the more common seeds of the garden and the farm, and of the weeds which are found most frequently in admixture, are now procurable in Europe, and are very convenient for reference by any one. Not only the amount of impurities (which may be inorganic as well as in the form of unwished-for seeds), but their nature, should be examined. Although there are on record some very surprising cases of careless or fraudulent admixture of foreign matters in seed, the general results of the examinations abroad and at home are rather encouraging.

Professor Nobbe gives the following figures: —

Percentage of Foreign Matters in Seed-Samples.

	Average.	Maximum.	Minimum.
Oats	1.02	4.80	.06
Beet	1.62	7.76	.33
Barley	.84	2.20	.30
Flax	2.25	13.65	.46
Pease	.74	6.49	–
Rye	1.67	6.37	–
Wheat	1.58	4.10	–
Indian corn	1.53	7.51	–
Onion	.47	.85	.25
Carrot	13.30	26.68	5.10
Tomato	2.13	4.14	.75

But the grass-seeds do not have so good a record.

	Average.	Maximum.	Minimum.
Orchard-grass	52.42	75.05	13.45
Timothy	5.09	19.39	.43
Red-top	74.92	–	–
Meadow-grass	48.33	83.81	.82

From the report for 1877 of the Connecticut Agricultural Experiment Station, the following figures in the first column are given: —

	Per cent by weight of Pure Seed.	Per cent of Impurity.
Oats	100	–
Beet	98.5	1.5
Barley	100	–
Wheat	100	–
Onion	100	–
Carrot	96.2 and 87.6	3.8 and 12.4
Tomato	100	–
Orchard-grass	81	19
Timothy	98.9	1.1
Red-top	55.5	44.5

The nature of the admixture is very different in different cases. Only one of the many specifications furnished by Nobbe is here transcribed.

RED CLOVER.	PER CENT.
Genuine clover-seed	94.56
Foreign seeds	2.197
Sand, &c.	3.243

The foreign seeds belonged to forty-four different species, such as ox-eye daisy, or whiteweed, clover-dodder, medick, plantain, sorrel, and five species of clover. The number of weed-seeds was 30,123 to the kilogram (or about two pounds) of clover-seed; or, as Nobbe most strikingly states it, "In the clover-seed needed for an acre there would be furnished, according to the sample, 1,300,000 seeds of weeds, or of plants other than clover." The author quotes the old English proverb, —

"One year's seeding is seven years' weeding."

The detection of admixture of different varieties of the same species, or of closely-allied species, is not an easy or a gracious task, if, indeed, the former is at all practicable. The discrimination between genuine seeds and most weed-seeds is not difficult, particularly to a practised observer.

The methods of determining the specific gravity of seeds need not now be mentioned, for we must take up the subject of estimating their germinative power. For ascertaining the latter, Nobbe employs an apparatus,[1] which consists of unbaked earthenware, with a channel for holding water, and a disk for supporting the seeds. The earthenware disk is kept sufficiently moist by the water around; and by aid of the cover, in which there is a thermometer, the temperature can be easily controlled. Near the supporting disk are four large glass receptacles, which contain a strong solution of potassic hydrate to absorb the evolved carbon-dioxide. Upon the moist disk one hundred or two hundred seeds, previously soaked, are placed, and the apparatus is kept at the temperature of 65° or 70° Fahrenheit. On no account is the disk to become dry. In a day or two, some of the seeds will begin to germinate, and the number which have sprouted

[1] The specimen apparatus exhibited at the lecture was of the dimensions recommended by Nobbe, — eight inches square and two inches high.

at a given date must be noted and recorded. Side by side with this apparatus, other seeds of the same sample are to be placed on moist blotting-paper, carefully covered, and kept damp.

At the Connecticut Station a simple and ingenious substitute for the Nobbe seed-testing apparatus was made from porous flower-pot saucers, placed in other saucers two inches wider, and containing water, the whole covered by an inverted flower-pot. That the apparatus thus suggested is efficient appears from the following statement of results: —

"In thirty-three trials made with the common field and garden seeds, both in Nobbe's apparatus and in unsized paper, —

"4,668 seeds sprouted in the apparatus.
4,604 seeds sprouted in the paper.
493 remained sound, without sprouting, in the apparatus.
470 remained sound, without sprouting, in the paper.

"Or, for over one hundred seeds which sprouted in paper, —

"101 sprouted in the apparatus.
10 seeds out of 104.7 remained sound in the apparatus.
10 seeds out of 108 remained sound in the paper.

"In twenty-two trials made with similar kinds of seeds, both in the saucer arrangement and in paper, —

"2,659 seeds sprouted in the saucers.
2,693 seeds sprouted in the paper.
286 seeds remained sound, without sprouting, in the saucers.
258 seeds remained sound, without sprouting, in the paper.

"Or, for over one hundred seeds which sprouted in paper, —

"99 sprouted in the saucers.
10 seeds out of 103 remained sound in the saucers.
10 seeds out of 114 remained sound in the papers."

The seeds of squashes, pumpkins, and some melons, do not give good results in the sprouting apparatus. It is best to cover them slightly with moist sand, and place a suitable cover over the receptacle to prevent evaporation.

The time of the experiments just referred to varies for different seeds; but generally it does not exceed four or five days. The number of seeds, which, out of a given number,

have germinated, is increased by adding to it a fraction, say one-third, of the sound seeds which do not sprout at once. The rule for determining the per-cent value is clearly stated in the Connecticut report previously quoted: —

"The 'per-cent value' of a sample of seed is obtained by multiplying its per cent (by weight) of pure seed into the per cent (by number) capable of germination, and dividing by one hundred."

Attention is to be directed to the difference in character between certain agricultural seeds, like corn, which are pure, and possess much vitality, and the forage grasses, which are seldom free from impurities, and which have low vitality. If this is disregarded, the results given in seed reports will be erroneously interpreted.[1]

Some of the results obtained by different experimenters in testing the vitality of seeds are here given.

1. Professor Nobbe at Tharand, —

AVERAGE SAMPLES.	AVERAGE PER CENT OF SEEDS CONSIDERED GOOD.
Red-top	21
Oats	74
Orchard-grass	22
Barley	88
Timothy	82
Pea	92
Buckwheat	71
Rye	89
Wheat	95
Corn	70
Carrot	59
Tomato	66

2. At the Connecticut Experiment Station, —

AVERAGE SAMPLES.	AVERAGE PER CENT OF SEEDS CONSIDERED GOOD.
Red-top	42
Oats	98
Orchard-grass	48
Barley	98
Timothy	95
Wheat	99.3
Carrot	34 and 57.5
Tomato	98.3

[1] Report of Connecticut Experiment Station, 1877, p. 49.

3. Professor Beal[1] at Michigan Agricultural College. The seeds were planted "in nice soil, which was very slightly screened from the sun."

Percentage of Sprouted Seeds in Samples.

	1.	2.	3.	4.
Squash	10	10	8	26
Onion	34	54	–	8
Carrot	30	14	–	10
Cabbage	34	72	32	–

The tables now given indicate sufficiently that there are wide differences between the seeds in market. The attempts now being made abroad to estimate the value of seeds are meeting with considerable favor at the hands of seedsmen. The chief points of seed-testing by which values are determined have now been briefly stated. The methods have been criticised as laboratory methods; but are such careful investigations less favorable to the seeds than are the chances which they stand at the hands of any cultivator? Are not the risks greater in the latter than in the former case? The whole question of seed-testing is one which is now fairly before the cultivators and seedsmen in some parts of Europe; and it is one which will, before long, become prominent here. It is one which is full of difficulties, and will lead, perhaps, to more or less ill feeling during its early trials.

It may be known to many persons present that in England there have been concerted and successful endeavors on the part of the large seed-houses to protect themselves and the public against fraud in seeds. To show how grave was the evil of which the dealers complained, reference need only be made to one or two cases as they have been given in English journals. It is not believed in any quarter that such serious evils exist in the seed-trade in this country.

1. *Reported in Gardener's Chronicle, 1877, Dec. 22.*

* * * on cross-examination.

In the sample submitted for analysis there were dyed thistle, Timothy, and rib-grass seeds.

[1] Rural New-Yorker, Feb. 2, 1878, p. 72.

Magistrate. How is the dyeing done?

Witness. They are soaked in a solution of indigo.

Mag. And how is the killing done?

Wit. I believe the seeds are usually killed by heat.

Mag. And the object of that is to prevent it growing, and when the harvest comes, to prevent it being known, so that the farmer may think his ground has failed, or that an insect has destroyed it?

Wit. Yes.

2. *Reported in Gardener's Chronicle, Dec. 1, 1877.*

In the course of the first prosecution, under the Seeds Adulteration Act, it comes out, that, during the trade, the purchaser of "killed charlock" said, "Why, there is nothing to fall back upon, if the seed should happen to grow."

The defendant said, "None of it will grow; and, if you find a single seed grow, I will put the whole lot on the kiln again for nothing." He further said, —

"When he killed seed he did not do it as * * * did it. I do it myself, and always carefully scrape the inside of the bags before refilling, so that not a single live seed remains."

Further. "It will do very well if sifted, — the larger seed for mixing with Swede, and the smaller with turnip."

The killed seed was said to be known in the trade by three noughts. It was said by * * * that people did not like to speak of killed or prepared seed.

In reply to the lord-mayor, who asked the meaning of the trade term or sign, * * * said, Nothing! nothing!! nothing!!!

In these two prosecutions, — one for dyeing seeds and adding the colored seeds as a fraudulent admixture; in the other for killing seeds, that they might be mixed with impunity with good seeds, — the better class of seedsmen appear to have given the prosecutors their hearty assistance. It is to be believed that any honest and earnest endeavor to improve the quality of seeds in this country, by accurately testing the value of average samples, would meet not only the approval, but receive the aid, of our seedsmen. The establishment of even a single careful seed-testing station like that at New Haven is to be welcomed by planter and seedsman alike. The cost of maintaining such an establishment as a branch, though an important one, of an experiment station, is not very great; but the results attained through its investigations are extremely important. The aim of such an establishment is to improve the quality of the seeds sold for planting, and this is an object sought also by seedsmen. Instead of any

thing approaching jealousy or ill-will, there should be co-operation, and doubtless this will be secured. Planters and seedsmen alike must agree with the saying quoted by Professor Nobbe, —

"For sowing, the best is not too good."

APPENDIX.

NOTE I. — THE EARLIER STATEMENTS RESPECTING MATURITY OF SEEDS.

"It is wonderful that unripe, imperfect seeds should germinate: the germinative power must be distinguished from other characteristics of ripeness." — THEOPHRASTUS, *De Causis Plantarum*, lib. iv. cap. 4.

"Seeds are ripe as soon as they can germinate; although, from their color, weight, and size, they may not appear to be ripe." — GÆRTNER, *De Fructibus*, ii. 1, cxii.

"Unripe radish-seeds germinate after eight days: nevertheless, ripeness is to be regarded a requisite for germination."— LEFÉBURE, *Expériences sur la Germination*, An. ix. p. 26, *quoted in Flora*, 1849, 497.

"Seeds must be ripe in order to germinate: ordinarily they will not germinate, if plucked before maturity. I have, nevertheless, seen germinate green and tender pease removed from their green, soft pods. If seeds rarely germinate before maturity, it is because the farinaceous matter is neither sufficiently abundant, nor sufficiently perfected, to ferment." — SENEBIER, *Phys. Veg.*, iii. 377, ii. 170.

"Kurr asked at the Association, whether any facts were known respecting the germination of unripe grass-seeds. He had had wheat-grains germinate, although they were hardly out of flower.

"The following conversation ensued: —

"Professor Mohl of Berne remarked, that, in these cases, germination takes place more quickly, because it is not necessary for the starch to revert to sugar in such cases, and therefore the process is cut short.

"Whereupon Dr. Kurr said that seeds which contain oil germinate sooner in an unripe state.

"Professor Kunze of Leipsic recalled the fact, that, in South Europe, wheat, while still green, is harvested, and yet good grain is obtained; and Chamberlain Waitz of Altenburg stated that the French rightly criticised Germans for their too late harvesting. He had himself, on one occasion, seen the unripe seeds of *Convolvulus nil* germinate. Dr. Gärtner of Calw called attention to the great differences in this respect in different families. Grasses especially germinate earlier than others.

"V. Martius of Munich stated, that, in Brazil, only the unripe seeds of mangava (*Willughbeia speciosa*) are planted, because of the belief that the fruit raised from such seeds is better than that from ripe seeds." — KURR (of *Stuttgart*), *Flora*, 1835, 4.

"Before the appearance under a lens of the radicle and plumule, the

unripe seeds of *Pisum sativum*, *Phaseolus vulgaris*, *Vicia Faba*, *Ervumlens*, and *Cytisus laburnum* fail to germinate; but as soon as these appear, although the seeds have attained only half-size, they germinate.

"In these experiments the unripe seeds were allowed to remain on the harvested plants until the leaves had become dry; then they were carefully removed with a sharp knife, and planted in rich mould, half an inch below its surface.

"Of 20 unripe *Pisum*, 13 (65 per cent) germinated by 9th day.
20 unripe *Phaseolus*, 11 (55 per cent) germinated by 17th day.
20 unripe *Vicia*, 9 (45 per cent) germinated by 19th day.
20 unripe *Ervum*, 7 (35 per cent) germinated by 12th day.
20 unripe *Cytisus*, 14 (70 per cent) germinated by 18th day.

"These and other results were so favorable, that Seiffer planted, in 1822, unripe seeds of *Sophora japonica*, and obtained from them five hundred young plants. These plants do not ripen seeds in South Germany." — SEIFFER, *reported by Kurr*, *Flora*, 1836, p. 83.

"At the conclusion of this paper Treviranus remarked that these researches left it uncertain what the degree of immaturity was. For a plant to possess firm cotyledons and a plumule and a radicle is to be a long ways towards maturity." — TREVIRANUS, 1836.

"Winter rye was harvested on June 20, three weeks before its time of ripening. It was planted on June 26, together with ripe seed of the year before. The ripe seed germinated on July 1, the other on June 28, two days and a half earlier. At first the plants from unripe seeds were weaker than the others; but by a fortnight or so no difference could be observed." — GOPPERT, *Bot. Zeit.* 1847, May 28, i. 386.

"This was followed by a study by Cohn.

"From the synopsis four statements are here given: —

11. "Seeds separated from the plant, but still enclosed in the pericarp, ripen (*nachreifen*).

14. "Viability does not coincide with ripeness, it precedes it.

16. "In general, the plants produced from unripe seeds are not more feeble than from ripe ones.

17. "Seeds appear to germinate most readily when they have reached a stage of medium ripeness. Before and after this, they germinate more slowly." — COHN, *Flora*, 1849, No. 32.

NOTE II. — CONCERNING VITALITY OF SEEDS.

"M. R. Brown m'a dit avoir fait germer des graines de Nelumbium speciosum, extraites par Lin. de l'herbier de Sloane; c'est-a-dire ayant au moins 150 ans." — DE CANDOLLE, *Géographie Botanique raisonné*, p. 542.

"Seeds of *Nelumbium* (*jaune*) have sprouted after they had been in the ground for a century." — LYELL'S *Second Visit to the United States*, ii. p. 328.

"Seeds of *Datura stramonium* have germinated after being buried for more than a century." — DAVIES, *Welsh Botany*, p. 23.

Other more recent cases by Ernst are given in botanical journals for 1877.

Dr. Wakefield. As we are about to leave, I ask the privilege of submitting this resolution: —

Resolved, That the thanks of the Board of Agriculture be hereby tendered to the Hingham Agricultural Society, and to the citizens of Hingham and its vicinity, for the generous entertainment afforded us, and for the interest they have shown in the promotion of this great national industry.

This resolution was adopted unanimously.

Mr. Whitaker. I am going to make another motion. Not being a member of the State Board, I want to move, on behalf of those of us who have attended these meetings, a vote of thanks to the citizens of Hingham for the kind manner in which they have treated us; for I do not know that they have made any distinction between the members of the Board and those of us who have come in who do not belong to the Board.

Another thing: I want to bear my testimony to the utility of the State Board of Agriculture of Massachusetts, not only in conducting these discussions, and in providing lectures on various subjects, as they have done, but also for giving their reports to the public at large. If there is any person present who has passed these publications over, simply because they came from the State, I would say that I have not a single volume in my library that I think is of as high value as any one of the volumes published by the Board of Agriculture; and I would most earnestly request every one to do what he can to have those volumes read and studied. I believe that any one who reads them carefully will find that he has obtained as much information on the subject of general agriculture as he will from any works that are published.

The question was put on Mr. Whitaker's motion, and it was unanimously carried.

The Board then, on motion of Mr. Smith of Colrain, adjourned *sine die*.

CATTLE COMMISSIONERS' REPORT.

To the Honorable Senate and House of Representatives of the Commonwealth of Massachusetts.

In compliance with legal requirements, the undersigned, Commissioners on Contagious Diseases among Cattle, hereby submit their Annual Report. The neat-stock interest of the State, in all its departments, has been prosperous during the current year. Owing to the transportation to our territory of cattle from the Far West and South-West, there has been for several years great danger to our native stock by the dissemination of the cattle-plague, or Spanish fever. The laws enacted to prevent this calamity have been effective during the present year; and no case of their infringement, or of the disease, has come to the knowledge of the Commissioners.

We have also been exempt from other contagious cattle-diseases, which have caused immense losses and serious derangement of trade in Europe, and, to a limited extent, in some of our sister States. The only official duties we have been called upon to discharge have been those imposed by Act of 1878, chap. 24. By this act, all the laws of the State relating to contagious diseases among cattle, and all the duties and powers of the Commissioners, are made to apply to horses, asses, and mules infected with the diseases known as "glanders" and "farcy." Though many cases of the disease have come to the knowledge of the Board, in only five have we found it necessary to act officially. Some cases have fallen to the care of the officers of towns and cities; but in eight cases in Springfield the owners of the animals willingly killed them by advice of Dr. Lyman, a veterinary physician of the place, without the interference of the authorities.

A most flagrant case occurred last season in the town of Chicopee, to which your attention is specially called, in the hope, that, by some legal enactment, such occurrences may be hereafter prevented. The owner of a sick horse in that town was notified by a regular veterinary practitioner that unmistakably the disease was glanders, and he was advised to kill him; instead of doing which, however, he repeatedly tried to sell or trade him. Failing in this, he gave him to an

ignorant street-boy, and disappeared. The boy, after enjoying the pleasure of horse-ownership for one day, turned him loose to wander through the streets and yards of the village, to drink at the public watering-troughs, and expose the many horses being used on the highway. The selectmen of the town were notified of the case, but, through some mistake or misapprehension, failed to look after it as the exigency required; and one of the Commissioners visited the town, and ordered the animal killed and buried at the expense of the State.

The attention of the Commissioners was also called by the proper town-officers to cases in Greenwich Village and Ipswich, and they were speedily disposed of by killing the infected animals. In this connection we would call the attention of the Legislature to certain enactments to prevent the spread of contagious diseases among cattle, and their application to the disease here spoken of. Sect. 1 of chap. 219 of the Acts of 1860 makes it the duty of the selectmen of towns, and the mayor and aldermen of cities, "in case of the existence in this Commonwealth of the disease called 'pleuro-pneumonia,' or any other contagious disease among cattle, to cause the cattle in their respective towns and cities, which have been infected, or exposed to infection, to be collected or secured in some suitable place or places in such city or town, and kept isolated, and, when taken from the possession of their owners, to be maintained, — one-fifth of the expense thereof to be paid by the town or city wherein the animal is kept, and four-fifths at the expense of the Commonwealth."

Sect. 2 provides that "said selectmen, and mayor and aldermen, — when any such animal is adjudged, by a veterinary surgeon or physician by them selected, to be infected with pleuro-pneumonia or any other contagious disease, — may, in their discretion, order such diseased animal to be forthwith killed and buried at the expense of such town or city." Sect. 3 provides that "said selectmen, and mayor and aldermen, shall cause all cattle which they shall so order to be killed to be appraised by three competent disinterested men, under oath, at the value thereof at the time of the appraisal; and the amount of the appraisal shall be paid as provided in the first section." That is, one-fifth of the

appraised value of the slaughtered animals shall be paid by the town or city, and four-fifths by the State. Sect. 1, chap. 24, of the Acts of 1878, provides that "the selectmen of towns, and the mayor and aldermen of cities, and the cattle commissioners of this Commonwealth, shall have and may exercise the powers, and shall be subject to the duties, for the prevention of the diseases known as 'farcy' and 'glanders' among horses, asses, and mules, and for the prevention of contagious and infectious diseases among domestic animals, that are now conferred or imposed upon them by the laws relating to the prevention of contagious diseases among cattle." Acting in accordance with the letter of these several enactments, during the present year the selectmen of one or two towns in the Commonwealth have caused horses declared by a veterinary physician to be infected with glanders to be appraised and killed, and have forwarded the bills for payment from the State treasury. The Commissioners entertain the opinion that it was not the intent of the several enactments herein quoted that the town and cities or the State should pay for animals already diseased, and of course, in the opinion of any competent disinterested veterinarian, unsafe and worthless; but, as the different acts now stand in their relation to each other, it is unavoidable.

There are good and imperative reasons why animals diseased with glanders should be killed and buried without compensating their owners; and we would therefore recommend the passage of an act making sect. 3, chap. 219, of the Acts of 1860, inapplicable to horses, asses, and mules infected with the diseases know as "glanders" and "farcy." If the present is a wise provision of law, that the Cattle Commissioners should, in cases of glanders and farcy, have and exercise the same supervision and control of the municipal officers of towns and cities as in cases of contagious diseases among cattle, sect. 2, chap. 24, of the Acts of 1878, should be so amended that it may apply to chap. 221 of the Acts of 1860. The Legislature of 1878 made an appropriation of two hundred and fifty dollars for the purposes of the Commission, only a moiety of which would have been expended, but for the enactment of the law in relation to glanders and farcy; but bills incurred under the provisions of that act,

already presented and approved, will consume the entire amount. If, therefore, during the current political year, the Commissioners are to discharge their duties under the laws to prevent the spread of contagious disease among domestic animals, a small appropriation will be needed for that purpose.

LEVI STOCKBRIDGE,
E. F. THAYER,
H. W. JORDAN,
Commissioners of Contagious Diseases among Cattle.

ANNUAL MEETING OF THE BOARD.

The Board met at the office of the secretary, in Boston, on Tuesday, the 4th of February, 1879, at twelve o'clock, Hon. Marshall P. Wilder in the chair.

Present: Messrs. Abbott, Baker, Bowditch, Brown, Comins, Damon, Davenport, Fenn, Goessmann, Goodwin, Grinnell, Hadwen, Hersey, Knox, Lewis, Long, Merrill, Moore, Phinney, Slade, M. J. Smith, Upham, Vincent, Wakefield, Ware, Warner, and Wilder.

A committee of three, consisting of Messrs. Moore, Slade, and Grinnell, was appointed to consider and report upon the order of business.

This committee subsequently submitted the following report: —

1. Reports of delegates to the societies.
2. Report of the Examining Committee of the Agricultural College.
3. Report of the Committee of Arrangements of the public meeting at Hingham.
4. Reports on subjects assigned for essays.
5. Miscellaneous and unfinished business.
6. Appointment of delegates to the societies.

The report was accepted and adopted; when, reports of delegates being in order, Mr. Comins reported upon the Middlesex North, Mr. Macy (read by the secretary) upon

the Middlesex, Mr. Lewis upon the Worcester, Mr. Slade upon the Hampshire Franklin and Hampden, Mr. Warner upon the Highland, Mr. Damon upon the Hampden, Mr. Grinnell upon the Deerfield Valley, Mr. Hersey upon the Berkshire, Mr. Upham upon the Housatonic, Mr. Hadwen upon the Hingham, Mr. Johnson (read by the secretary) upon the Bristol, Mr. Merrill upon the Plymouth, Mr. Goessmann upon the Marshfield, Mr. Fenn upon the Nantucket, Mr. Smith upon the Martha's Vineyard, Mr. Davenport upon the Worcester West, Mr. Vincent upon the Worcester North, Mr. Moore upon the Worcester North-west, and Mr. Ware upon the Hampshire.

Messrs. Slade, Grinnell, and Wakefield were appointed a committee on the credentials of newly-elected members.

Major GRINNELL, chairman of the committee on the subject, then presented and read the following report upon

SHEEP-HUSBANDRY IN MASSACHUSETTS.

In preparing a report on the sheep-husbandry of Massachusetts, it is not necessary nor advisable at this late day, and in view of all the information on the subject, — so thoroughly scattered among the people by the various books, reports, and excellent agricultural papers, — to go back into the early history of the sheep, nor to particularly describe all the breeds that have been or are cultivated in this or other countries, nor to discuss the matter of the production and consumption of wool as affected by the various protective tariffs through a long series of years. These matters were treated at some length in a report made to this Board in 1860, and also, soon after, in the report of the Department of Agriculture at Washington; and all that would seem to be required of us is to show to the Board, and through it to the farmers of the State, the present condition of this branch of our agriculture as compared with the past; to account, so far as we can, for its depreciation; to suggest any remedy; and finally to endeavor to convince the farmers of the State of the profitableness of raising and feeding

sheep by showing to them the results of the experience of men of their own class and in their own State. The results of this experience, worked out by years of observation and practice, attended with losses and disappointments as well as success, should have weight with other farmers, who, under the disadvantages of high taxes, costly labor, increased expenses, and low prices for all the products of the farm, are seeking the most profitable return for the capital invested in their farms, stock, and implements, and for the toil and drudgery of themselves, their families, and of their hired laborers.

If there be any force in the suggestions we offer, it should tend to induce some of our farmers to change somewhat their course of farm-management, and, smothering old prejudices, to try something a little different from their established lines of farming, — perhaps to feed sheep instead of cattle; perhaps to substitute sheep and lambs for dairy cows; or, again, for those who have large flocks of fine-woolled sheep, to try a smaller number of coarse or middle wools, where the mutton and lamb should be the first consideration, and the wool the secondary; though, at the present time, the fleeces of these last are worth nearly as much, sheep for sheep, as those from the fine-wools.

While we do not intend to give an elaborate history of the introduction of sheep into this country, yet it seems not amiss, at least for us of the descendants of the Pilgrims, to trace the coming-in of this most useful animal to the Colonies of Plymouth and Massachusetts Bay.

Either the sheep were not very early introduced here, or the old chroniclers did not see fit to make any special mention of them, unless under the general head of cattle: horses, cattle, and, strangely, goats are much earlier and oftener noticed than sheep. In 1629 royal permission was given to ship from Southampton a hundred and forty cattle, horses, sheep, and goats. How many, if any, were landed, does not appear. July, 1631, from Barnstable in Devonshire, were shipped eight heifers, a calf, and five sheep. June 15, 1633, thirty-four Dutch sheep were landed, forty having been lost at sea; and April 3, 1635, eighty-eight Dutch ewes were brought in, valued at fifty shillings each. These Dutch sheep were rather large, white-faced, no-horned sheep, long-

legged, and with a light fleece. They were of English origin long before the introduction from Spain of the Merinos into the lowlands of Holland and the Texel.

In 1633 mention is made of sheep taken to one of the islands in Boston harbor for protection against wolves and dogs. July, 1633, an order was made that no sheep should be exported under a penalty of the value of the sheep. May 14, 1648, the following order was made by the court, "that forasmuch as the Keepinge of sheepe, tends to the good and benefit of the Country; if they were carefully preserved, henceforth, it shall be lawful for any man to Keepe sheepe in any Common, accounting 5 sheep to one great beaste and if any dogge, shall kill any sheepe the owner shall either hange his dogge forthwith or pay double damages for the sheep; if ye dogge hath been seen to course or bite any sheepe before, not being "sett on," and his owner had notice thereof, then he shall both hange his dogge and pay for the sheep."

In 1654 an order was passed by the court, "Whereas this countrye is at this time in great streyghts in respect of cloathing, and the most liklyest way tendinge to supply in that respect, is the raysinge and Keepinge of sheepe within our jurisdiction, it is therefore ordered and enacted by this Court and the authoritie thereof, that after the publication hereof, no person or persons whatsoever, shall transport any ewes or ewe lambs out of this jurisdiction to any forraigne port or place, uppon the penaltie of the forfeiture of five pounds for every ewe or ewe lamb so transported." In 1652 Charlestown had as many as four hundred sheep, and in 1658 John Josselyn wrote, in the account of his voyages to the Colonies, of there being eight hundred at Black Point in this State, and again mentions "their having great store of sheepe" in the Colony. Twenty years later they had so much increased, that Sir Edward Randolph, a commissioner of the crown, wrote in his official correspondence that "New England abounded in sheepe."

The sheep at that time imported came from various localities in England which it is impossible to fix, and some from Holland. Most of these were white-faced, generally hornless, with light fleeces of middle wool. Some of them, with dark faces, were undoubtedly Sussex sheep from the downs of that county, imported long before Mr. Ellman had

commenced his great improvements to perfect them into the splendid "South-downs."

The Merinos were introduced by Gen. Humphreys, minister to Spain, from that country in 1802.

DESTRUCTION OF SHEEP BY DOGS.

For the purpose of ascertaining to some extent the opinions and feelings of the farmers throughout the Commonwealth, the Committee, adopting the plan of the Committee of 1860, in this Board, sent out some two hundred circulars proposing certain questions regarding sheep-husbandry.

These were faithfully distributed by the members of the Board, and a very liberal response was made from more than one hundred sheep raisers and feeders in the State, who will hereby please accept our thanks for the attention.

To the inquiries in our circular, "Has the destruction of sheep by dogs prevented sheep-raising, and to what extent? and what cause is there, except the ravages of dogs among flocks, why the keeping of sheep should not be general and profitable?" almost all of over a hundred replies are, that the destruction of sheep by dogs has affected sheep-raising injuriously. Some had not been troubled to a very serious amount; while many think it has nearly driven that industry from their neighborhoods, and deprived them of a most profitable business; and all, with a very few exceptions, speak of it as a paying and desirable industry. Two or three sheep-masters from Berkshire, where large flocks of fine wools have for many years been kept on the extensive ranges running over the southern end of the Green Mountains, complain that depression in price, and fluctuations in the tariff on wool, have discouraged their business of wool-growing; and two or three replied that poor fences and inattention have had some effect in reducing the number of sheep kept. We ought also to mention that one shepherd in South Berkshire thinks wild-cats have slaughtered more sheep for him than dogs. He, however, proposes no remedy. We do not purpose to enter into any discussion of this question, nor to pile up statistics. The matter is thoroughly understood throughout the Commonwealth; and the wrongs which farmers and those who would raise sheep have endured must still be borne so long as Legislatures are

composed of dog-owners and dog-lovers themselves, or are controlled by those who are. We do not know, and have no means of ascertaining, how many dogs there are in this Commonwealth. Probably not over one-half are taxed: dog-owners will avoid taxation if they can. Assessors, selectmen, constables, and all dog-owners, will shirk all possible responsibility in assessing, taxing, prosecuting, killing, or in appraising slaughtered sheep. They generally love their dog better than they do their neighbor — if he is a sheep-owner.

In 1860 this State carried 114,000 sheep and 112,000 dogs. At the present time we have less than 55,000 sheep; while we have no reason to suppose that the dogs have decreased, but the contrary; so that we have more than two, perhaps three, dogs to every sheep in this State of Massachusetts, where agriculture and manufacturing interests are supposed to be cared for and protected. Especially is it our boast and claim in the small districts, that the rights of those who till the soil, and supply the products which support the consumers, are and should be guarded; and yet there is not a farmer in this Commonwealth who can with any safety attempt to keep a flock in any pasture through the summer.

It is a shame to our legislation, and to the community in which we live, that those who would like to breed and raise the best varieties of this most useful and remunerative animal should be debarred this right by the prevalence of a nuisance. We have a "dog-law," so called, and much money comes in to the treasury; but the amount that goes to the farmer who has suffered from dogs, and been compelled to look to the "dog-fund" for recompense, is small. The alleged worth of the sheep killed, without consequential damages (always undervalued by the appraisers), is grudgingly paid at the end of the year. But the mere loss of the dead sheep is only a small part of the matter; more are bitten, torn, mangled, and scared almost to the point of death; the flock is scattered, sometimes for days, and so utterly demoralized, that the animals do not recover for a whole season.

A farmer who has had a raid into his flock in the spring is kept in a constant state of anxiety about his sheep for a whole summer.

It is not only he who has his flock raided who is affected.

One such sight as a couple of savage dogs tearing the throats, and mangling the bodies, of a flock of sheep, settles the question of raising that profitable animal in the minds of a whole neighborhood; and hundreds of farmers who never have ventured on this branch of industry would do so if they could with any safety.

In the year ending May 1, 1875, there were reported 11,489 dogs as having killed 1,673 sheep.

In 1878 there were about 10,000 dogs taxed, and sheep killed to the amount of $10,584.53.

Sheep breeding and growing in Massachusetts have, in recent years, been pretty distinctly divided into wool-growing and meat-producing. Formerly the growth of the wool-crop was the most important. First, as the necessities of a newly-settled country without commerce required, and afterwards, as the separation of the Colonies from the mother-country threw them upon their own resources for clothing, wool-growing was necessary and profitable. Encouraged by the manufacturers, by wealthy individuals, and by legislative enactments, this continued for many years, till in 1840 the sheep amounted to 378,226 in number, and the pounds of wool to almost 1,000,000; in 1875 the sheep numbered 58,873, and the wool amounted to 206,935 pounds. A very remarkable fact, and one which should have great weight with those who consider this matter wisely, is, that the price of the wool from both kinds of sheep has approached very nearly the same value; while the average of fleeces has increased in weight from two pounds and a half of the fine wool to over four pounds in the improved varieties of larger breeds.

Formerly flesh was a secondary consideration with the farmers, fine wool commanding so high a price, that it paid farmers for raising that alone, calling the mutton nothing. Thousands of sheep were slaughtered for little more than the pelts that covered them. But the case is now very much altered. Very fine wool is by no means so much in demand; habits are different; men do not generally wear so fine cloth as formerly. The war had much to do with the change; and fine wool is grown so much cheaper in the West and South-West, that the result from the operation of all these causes is, that coarse and middle wools are worth almost as much

per pound as the Saxony and Merino. The fleece of a large mutton sheep will bring about as much money as that of a fine-wool, whose carcass is worth less than his pelt; and the product in lambs of the former is worth four times that of the latter in the market. Combing-wool, which is from the Cotwolds, Leicester, and their grades, is in more demand, and fetches a higher price, than the Merino.

Beyond the few dissenting answers given above, it is not easy to give any satisfactory reason, except the fear of dogs, why sheep-husbandry should not take the first rank in all agricultural operations in Massachusetts, as being an industry not requiring large capital, making quick and very large returns on the investment made. Our soil is well adapted for grazing sheep. They delight in rolling and hilly land, and are most indiscriminate feeders, requiring variety. They pass from the sweetest clover to the bitter white-weed; they gnaw the weeds, briers, and sprouts, and, going rapidly from one spot to another, clear off the foul stuff, leaving their manure — the best that comes from any of our farm-stock — scattered widely over the fields in such a form as to enrich the soil to the best advantage, not creating the rank, unsavory growth that follows from the more gross droppings of the horse or the cow. They incline to the higher portions of their feeding-grounds; so that the fertilizing qualities wash down the slopes, to the benefit of the lowlands.

Our climate, too, is well adapted for these warmly-clad animals. They do not suffer from cold, and can start for pasture early in the spring, and continue late in the fall; though they are too often allowed to remain out, cropping frost-bitten grass, later than is prudent for their good condition. To be sure, in winter to be profitable, they should be well housed, more for dryness than for warmth, and well fed; but there is no stock to which a farmer can so well feed his hay and grain as to sheep.

The manure from sheep, when kept up, of course varies in quality with the amount of meal or grain fed, as is the case with other animals. But the manure from sheep is always regarded as much more valuable than that from any other animals: one reason is its very thorough digestion; then, if well littered in their sheds or houses, the excrements, solid and liquid, are all preserved, and trodden down firmly. The

tables of Boussingault and of Lawes, acknowledged authority, place the value of sheep-manure as thirty-six pounds worth one hundred pounds of that of other animals.

WINTER TREATMENT.

There is no doubt but that, with a flock of coarse or middle wooled sheep, it is better for the sheep, the land, and the owner, to keep them housed or sheltered, and well fed under cover in winter, than to turn them out to gnaw a field of turnips, as is practised in the milder winters of England, or to wander round the fields, picking a poor living from coarse hay, or corn-stalks, or dead grass, as is sometimes allowed in New England.

Cold is not to be so much guarded against as wet. Sheep should have plenty of yard-room, a comfortable house or shed, that may be closed if necessary, but with plenty of ventilation. They should be fed regularly; and the practice varies somewhat. Some feed three times a day with hay, and at noon a small feed of roots or corn: others feed twice, with half a pint of corn at noon, and corn-stalks, bright oat-straw, or other coarse fodder, at night.

For fattening, the best feeders give corn, commencing with a half-pint, increasing to a pint. Many feed a little cotton-seed meal and some Indian, sometimes with oats and barley ground with the corn, a little salt weekly; and pure running water always accessible is indispensable. A successful sheep-grower of Massachusetts says, "The kind of food supplied to sheep is hardly of greater importance than the method of giving it. Sheep are powerful digesters, and are capable of converting the dryest and coarsest herbage into food, and extracting from it more nutritive matter than any other animal. In proportion to their weight, they will consume, therefore, a larger amount in bulk.

"The instinct of sheep leads them to select high and dry grounds, and to range widely, feeding upon almost every variety of herb and shrub. Linnæus found, by offering fresh plants in the ordinary mode of feeding, that horses ate 274 species, and rejected 212; cattle ate 276, and refused 218; while sheep took 387 species, and refused only 141.

"In my winter management of sheep I give a fair amount of nutritive food of every kind that it is good economy to

use, to keep them in good condition; but, whatever the kind may be, I make it a point to add fodder enough of a coarse and bulky nature to keep their bellies full.

"My practice has been, to feed three times a day, — in the morning with good hay; at noon with one of the following articles, Swedes, rutabagas (after January, mangolds), oats, Indian corn, and linseed or cotton-seed meal, varying the kind given as often as possible according to my supply; at night a full supply of coarse fodder. This is my winter treatment, always taking care to have the flock supplied with shelter and water.

"In many years' experience I have had so few cases of loss from disease, that I should have to put the percentage down to a fraction too small to be worth mentioning. Of course with breeding-ewes this diet should be somewhat improved as the season advances and the lambing-time approaches, — by rowen-hay, and more roots, and a little additional corn or meal to promote a flow of milk. After the lambs are three or four weeks old, they will begin to eat a little meal; and it is a common practice to allow them a pen into which the ewes cannot enter, where they are allowed to eat meal at will, and fine rowen. Sheep consume about three per cent each of their live weight of good hay, or its equivalent, daily; and two pounds of hay with a half-pint of corn, or a pound of good hay and two pounds of oat-straw or bright corn-stalks, is about the proper amount allowed for a sheep weighing a hundred pounds. Wet seasons and wet soils are destructive to sheep; and English flock-masters lose annually thousands of sheep from this, and their system of feeding turnips from the field in winter, and in not protecting them from the weather."

The reason why sheep will suffer from a moist climate in winter and a wet feeding-ground is obvious. The temperature of the healthy sheep is higher than that of any other domestic animal, running to about 104° Fahrenheit; and while the thickness of the fleece, with its oily nature, will repel much rain and moisture, nothing tends to lower this temperature so thoroughly and so long as continued moisture, and the soaking of the fleece to the skin with wet; and, in proportion as the temperature is lowered, the sheep loses health and condition. All that it can get to eat goes to fur-

nish the carbon necessary to expel the cold from the system, and not enough is left to supply the other wants of the stomach.

Mere outward dry cold has comparatively small effect on the sheep, protected by its thick fleece. All our climate requires is good care and reasonable shelter.

SUMMER TREATMENT.

One of our correspondents has suggested, that, in his neighborhood, insufficient fences were an obstacle to sheep-raising. Theoretically this objection should not obtain; but practically it does, and at present cannot be altogether avoided. Much, however, can be done to remedy it. In the first place the large breeds of sheep and their grades — such as we should generally recommend for raising to grow lambs and make mutton, rather than purely fine-wools, only for their fleeces — are by nature and by cultivation less liable to climb stone walls, and jump fences, than the others. Much also may be done, by care and good management, to prevent this. It is not unfrequently the case that some particularly sagacious old ewe, filled with feminine curiosity, and an unrestrainable desire to pass fixed limits, — to roam from home, and persistently to lead to "fresh woods and pastures new," — may be sequestered from the flock to the great advantage and comfort of the owner.

It is very important that the fences should be gone over in the early spring, before the sheep are turned out, holes stopped, rails put up, and gaps in the stone walls relaid. Much, also, may be done by improving the pastures, and increasing the chance for grass and good herbage, by cutting sprouts, sweet-ferns, hardhacks, and other useless plants which have grown too large for the sheep to browse. Defective stone walls, the stones having been tumbled half way down the wall, afford an easy egress for sheep. A good stone wall properly laid is in many parts of the State the cheapest, safest, and most enduring fence that can be made; and nothing will pass it, if securely laid, and of a proper height. One mistake is in not taking sufficient pains in the laying. With reasonable skill a "balance wall" may be laid four feet high, that will last for generations, and turn every kind of stock: it may be kept in constant and easy

repair by going round it once or twice a year, and relaying with care the stones that have been pushed off by the pot-hunting dog-owners of the Commonwealth, who knock down our walls, trespass on our fields, and worry our sheep.

We are quite sure that farmers do not take reasonable care in repairing fences. How often is it, that, in the spring, an unskilled Irishman and a boy with an axe are sent out to mend up the fences! — which they do generally by driving a couple of rotten stakes crosswise, on which they lay a broken rail; or cut a sapling partly off, to lie along a length or two of dilapidated wall or rotted fence; or repairing a gap in a wall by picking up a stone at random, placing it carelessly, or without bedding, on the low place, regardless of those thrown off which offered a convenient stile for the sheep or the recrossing hunter. Where stones are plenty, and the farmer can afford the necessary additional labor, a double wall is, of course, the best.

The best cheap fence we ever saw was a double wall — made from round stones, bowlders, cobbles, water-worn stones from six to sixteen inches in diameter — four feet high, three feet on the bottom, and with a "batten" of about an inch and a half to the foot on each side. When walls are so low or so poor that they cannot be relaid, the best and cheapest way is to pole them. In almost every neighborhood where sheep and stone walls abound, staddles can usually be found and cut, from three to six inches in diameter, and from sixteen to thirty feet long, which, supported on stakes driven crosswise the wall, will add a foot or more to its security at a small expense.

Sheep should not be turned to pasture in the spring till the grass has well started; and, before turning them out for the summer, it is an excellent plan to let them run in a field near by, if convenient, for a few days, giving them a feed of hay morning and night. Before going out finally, they should be carefully looked over to see that they are sound, and in proper condition to go out. It is said that bells hung around the necks of a few sheep will keep off dogs. Every man who has a flock of sheep and takes care of them, and enjoys it as he should, will know every sheep in his flock; and he ought to see them in the pasture every day. But how few do that! In many cases it is impracticable, as the sheep

are turned away on the most distant pastures; and the owner thinks he does his full duty if he sees and salts them once a week. This really is not justice to the flock. The acquaintance between the flock-master and the sheep should be intimate, and be maintained. Accidents to sheep and lambs are liable to occur, which may be remedied: a gap in the wall, or a hole in the fence, may be noticed; and one might be able to anticipate or identify some sheep-killing dog, and save his flock from destruction.

The operations of castrating, when the lambs are to run as wethers, which should be done before they are ten weeks old; of docking, which should follow soon; of tagging, before they are turned out; of washing (now much less done than formerly); and of shearing, — are all well enough known.

In salting sheep in pasture, when it can be done in troughs it is an excellent plan to smear the bottom and sides with tar, a little of which, sticking on the nose of the sheep, will be a pretty effective preventive against the fly which enters the nostril, and deposits the eggs from which the grub in the head is produced, causing great annoyance, and sometimes death.

Sheep should be brought to the barn before the herbage is gone: if left out in cold storms, with nothing to eat but a meagre supply of frosted grass and weeds, they must necessarily suffer in condition, and require unusual feed and attention to bring them up.

Another result from this treatment is a damage to the wool, which stops growing, and is greatly injured in fibre.

DISEASES.

We are, in this State, comparatively free from many of the diseases that affect the sheep of England. There is no doubt that our climate and soil are exceedingly favorable to sheep-husbandry. Our sheep are more generally in smaller flocks, and are better cared for than formerly; and for this reason, perhaps, all forms of disease that affect the sheep are becoming less every year.

The diseases of the old country and of old times, such as the "rot" (not foot-rot), caused by flukes or parasitic insects in the liver; "louping ill," or "trembling," something like apoplexy; "sturdy," or "turnsick," caused by hydatids on

the brain; "braxy," or dysentery; and others, — we know at the present day almost nothing of. The only diseases we have which are epizoötic are the "foot-rot" and the "scab."

The foot-rot is a disease which attacks the foot where the hoofs unite with the bony structure, and in the cleft between the hoofs. If not attended to, it suppurates, and becomes so painful, that the poor brutes hobble about on their knees; and finally the hoofs come off and the sheep are lost. But, with any proper attention, this may be checked in its early stage: if not, it will spread through the flock. It is supposed to be caused by an undue amount of moisture under foot, which softens the hoof, and causes an inflammation and consequent decay of the tissue. The remedy is to pare off the diseased portion, wash off the putrid matter, and apply a mixture of tar, lard, oil of turpentine, and diluted sulphuric acid: if a caustic is required (and sometimes a single application early is sufficient), apply with a feather butter of antimony, or sulphate of copper (blue vitriol), followed by a mixture of tar and lard. After treatment, the diseased sheep should be kept on a dry footing, and, if on a floor, a little lime sprinkled on it acts as a preventive. Too much care cannot be taken if this disease once gets in; but it can be cured by a repetition of this treatment.

The scab, which is another contagious disease, is caused by an infinitely small insect, called the "acarus," which burrows in the skin, and causes intense itching. The animal rubbing or scratching this produces a scab, which spreads the mischief on the infected sheep, and is soon communicated to the whole flock: the wool comes off in patches; and the animal pines away. As soon as this is discovered, the diseased sheep should be separated, and dipped in a strong decoction of tobacco, to which, sometimes, an ounce of blue vitriol to a pound of tobacco is added. A solution of arsenic is also used in England: two or three dippings at intervals of two or three weeks will effect a certain cure.

Ticks are sometimes very troublesome and exhausting, especially to lambs, upon which they will sometimes gather in great numbers, if neglected. A sure and effectual remedy is to dip the lambs in a strong decoction of tobacco: two dippings will certainly finish them, and one is generally sufficient.

The bot-fly, *Œstrus ovis*, is sometimes annoying and dangerous. Tarring the noses of the sheep is a safe preventive. When sheep show signs of being tormented by the grub, a little snuff, or pepper, or tobacco-smoke, blown into the nostril, will sometimes cause it to sneeze out the offending worm.

PROFITS.

In speaking of the profits of sheep-husbandry, and of those who earn them, we write of farmers who are disposed to be careful in their farming, prudent in their expenses, and painstaking with their stock.

Nothing can be profitably produced from any farm without labor, care, anxiety, and personal attention. But keeping a few sheep to roam at large through the summer, without overlooking them when in pasture, and watching them at the lambing season, carelessly and irregularly feeding them in winter, or allowing them to pick up a scanty subsistence from the refuse stock of the barn, is not sheep-husbandry. It is too common for farmers thus to treat their sheep: this will not pay, and farmers will find that it will not. Instead of better treatment and greater attention, by which a good profit is assured, they are too apt to abandon sheep as a profitless animal. There is no animal which rewards its owner more generously for the food, shelter, and care extended to it than the sheep. The profits derived from sheep come in three or four different modes of farming: first, where the wool-crop is the prime consideration. This, however, with us now is almost entirely giving way to the others, where the production of meat is first, and the wool auxiliary.

The fine-wools, in 1875, were only 16,507, yielding 77,357 pounds; while the others were 42,686, giving 129,578 pounds; and the proportion of coarse-wools is still larger in 1878.

The second mode of sheep management is that of stall-feeding for mutton; a third, that of raising early lambs, partly stall-fed, never going to grass; and, fourth, raising lambs coming forward to go to grass with their dams, and sold from the pastures.

At the present time the fine-woolled sheep are probably only about one-third of all: they are out-numbered by the coarse-wools in every county. In 1875 the total value of the

sheep in the Commonwealth was $246,217; the number of sheep, 58,773; the wool was $84,563, and the lambs 115,000, the two amounting to $199,563, showing a return of nearly $3.50 for keeping each sheep. The mutton sold amounted to $55,374.

This is the showing of the whole State, including all sheep of every description. Our circulars from farmers make even a better showing.

The profits of raising early lambs, as shown by arranging and averaging the figures as given us by some thirty or forty of our correspondents, — the most successful of whom in this branch are decidedly from Franklin County, — are somewhat as follows: —

For a moderately small flock of, say, fifty good graded ewes, at $4	$200 00
One good ram, $25	25 00
Pasturing, salting, washing, shearing, &c., at $1 per head	50 00
Winter feed for ewes, — hay, meal, and roots, — at $2.50	125 00
Winter feed for lambs dropped in January or February, at $2	100 00
	$500 00

RETURNS.

Fifty good ewes will have at least sixty lambs, of which forty will fetch $6	$240 00
Twenty lambs, later and smaller, at $4	80 00
Two hundred pounds wool from ewes, at 30 cents	60 00
Five cords of manure, worth $5 per cord	25 00
	$405 00
Deduct fifteen per cent on cost of original flock, which you still own	33 75
And you have for your care and feed of your flock of fifty sheep	$371 25

This showing supposes the lambs to be dropped in January or early February, in a warm place, and to be fed with some grain or meal the last two months or more before being sold, never having eaten grass. Another plan practised by many farmers is to have the lambs dropped later, — say the last of March or April, — that they may be strong, and well able to go to pasture with the ewes. These receive no meal nor grain, and are sold from the pastures in July or August, for from three dollars to four dollars per head. The first

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method disposes, to the very best advantage, of the farmer's hay and grain, and gives a much larger return: the latter course is a favorite one with many, because "it's less work."

As an illustration of good management with lambs we condense a statement made by one of the most intelligent and thrifty farmers in Franklin County: —

"I have seventy-five grade ewes of Cotswold and large Merinos, which cost for summering-pasture, &c., eighty cents per head. They are brought up in good season in the fall, and through the winter have three feeds a day of rowen-hay, with one of roots in the morning, and half a pint each of cotton-seed meal, Indian meal, and bran, equal parts. My ram runs with the ewes till the middle of September: he is then taken out, and kept from them until Nov. 1; so that most of my lambs are dropped prior to Feb. 15, for early market, and the remainder in April, to be sold in summer, or kept for winter feeding. The first I regard the most profitable. They have free access to a mixture of two-thirds oil-meal and one-third home-grown corn-meal, with fine rowen, and go to market at from three to four months old, and bring from nine to twelve cents per pound: a fair average is seven dollars per head. My ewes are worth from five to six dollars per head, and cost about two dollars and a half each for winter keep, while the lambs eat less than two dollars' worth. My fattening sheep have two feeds per day of rowen, and a pint each of two-thirds corncob-meal and one-third cottonseed-meal in the feeds after the hay at morning and night. They are generally sold in March or April, and fetch from six to seven dollars a head."

He adds, —

"Dogs have materially injured sheep-husbandry, and should be restrained. Make the dog amenable to the law, as much as the sheep; pass a law, that, if any person keep a dog, that person must keep the dog on his or her own premises."

FATTENING SHEEP.

There is a good profit in feeding sheep, yearlings, drafted or barren ewes, or sheep brought from Canada or the West when our own supply falls short. These, if put up in good condition, and well fed, will add to their live weight, in four or five months, one-quarter, and nearly double in mutton value their cost.

Fifty wethers, ewes, or yearlings, weighing, say, a hundred pounds, at $3	$150 00
Six tons of hay, at $20	120 00
One hundred bushels corn, at 75 cents	75 00
	$345 00

RETURNS.

Fifty sheep, at a hundred and twenty-five pounds each, 6,250 pounds, at $5\frac{1}{2}$ cents a pound	$343 75
Five cords manure, at $5	25 00
	$368 75

This shows a sale to the sheep of hay and corn at about double its actual cost to the farmer, and giving him a quantity of the best manure.

The testimony of almost all farmers is, that they can make money by feeding sheep, i.e., they can dispose of their hay and grain to the best advantage, securing a quicker and safer return than from any other stock.

One of the largest and most highly regarded farmers of Middle New York says that a man who buys sheep prudently, feeds judiciously, and sells them fat, cannot well fail of success; that for eighteen years he has fed large numbers, and only made one loss.

In concluding, we venture the hope, as practical men, that some farmers may find, in the foregoing, matter for attention and consideration. As a matter of curiosity we add an action of our Puritan ancestors, not before generally published, showing in a strong light their minute, practical, sagacious, and solemn dealing with the sheep-husbandry more than two centuries ago.

ORDER OF GENERAL COURT, MAY 14, 1645.

"Forasmuch as wollen cloth is so useful a commodity without which wee cannot so comfortably subsist in these partes by reason of could winters, — it being also at present very scarce and dear amongst us and is likely shortly so to be in all those parts from whence wee can expect it by reason of y^e^ warrs in Europe destroying in a great measure y^e^ flocks of sheepe amongst them, and also y^e^ trade and means it selfe of making wollen cloaths & stuffs, by y^e^ Killing and otherwise hindering of such persons whose skill and labors tended to y^t^ end; whereas through y^e^ want of wollen cloaths & stuffs many poor people have suffered much could and hardship to y^e^ impairing of y^r^ healths and y^e^ hazarding of some of their lives and such who have bene able to provide for their childrens cloathing of cotton cloth (not being able to get other,) have by that meanes had some of their children much scorched with fire, — yea divers burnt to death, this Court therefore taking into consideration our present condition in that particular, as also haveing an eye to y^e^ good of posterity, (Knowing how necessary and useful wollen cloths and

stuffs would be for our more comfortable cloathing and how profitable a marchandize it is like to be to transport to other parts), doth hereby desire all y^e^ towns in generall, and every one in particular within y^e^ jurisdiction, seriously to weigh y^e^ premises and accordingly that you will carefully indeavor y^e^ preservation and increase of such sheepe as they have already, and to also procure more with all convenient speede into their severall towns by all such lawful wayes and means as God shall put into their hands, and for y^e^ better effecting here of wee thinke mete that it be propounded to each severall towne being called to assemble together, to Know who will buy ewe sheep at the rate of 40 shillings apeece under three years old and how many they will be bound to buy, and in what way they will make payment, that so there may be some course taken for y^e^ sending for them into other parts abroad, and that each town would appoint one of them selves who shall take a note of y^e^ names of such as are willing to further the worke, together with the number of the sheepe they will buy, and the nature of their pay as aforesaid, and shall return the severall notes to Major Gibon his house at Boston at or before y^e^ first of y^e^ 7^h^ month next, and further it is desired that such as have an opportunity to write to any of their friends in England who are minded to come unto us, to advize them to bring as many sheepe from thence as conveniently they can, which being carefully indeavored we leave y^e^ succease to God."

Applying this last sentence to our own attempt in this behalf, we submit this as our report.

JAMES S. GRINNELL,
ARTHUR A. SMITH,
JOHN E. MERRILL,
For the Committee on Sheep-Husbandry.

The report, after some discussion, was accepted, when the Board adjourned to ten o'clock on Wednesday.

SECOND DAY.

The Board met at ten o'clock A.M., Hon. MARSHALL P. WILDER in the chair.

Present: Messrs. Abbott, Baker, Brown, Clark, Comins, Damon, Davenport, Demond, Goessmann, Grinnell, Hadwen, Hersey, Knox, Lewis, Moore, Phinney, Pierson, Slade, Upham, Wakefield, Ware, Warner, Wheeler, and Wilder.

The Committee on Credentials submitted the following

REPORT.

The Committee appointed to examine and report upon the credentials of newly-elected members respectfully report that they have attended to that duty, and find the following duly elected: —

E. Frank Bowditch	by the	*Massachusetts Society.*
John B. Moore	"	*Middlesex.*
Velorous Taft	"	*Worcester South-East.*
J. Howe Demond	"	*Hampshire, Franklin, and Hampden.*
William R. Sessions	"	*Hampden.*
Horace P. Wakefield	"	*Hampden East.*
Henry M. Pierson	"	*Berkshire.*
Merritt I. Wheeler	"	*Housatonic.*
Edmund Hersey	"	*Hingham.*
George M. Baker	"	*Marshfield.*
Alexander Macy, Jun.	"	*Nantucket.*

Dr. James R. Nichols of Haverhill, appointed by the Executive.

Avery P. Slade.
James S. Grinnell.

Messrs. Wakefield, Brown, and Bowditch were constituted a committee to report upon the assignment of delegates.

Messrs. Clark, Grinnell, and Moore were appointed a committee to consider and report upon subjects to be assigned to committees for essays.

Mr. Phinney then reported upon the Middlesex South Society, Mr. Clark upon the Essex, Mr. Smith (read by Mr. Grinnell), upon the Worcester South, and Mr. Baker upon the Hoosac Valley.

Professor Goessmann submitted his Sixth Annual Report as Inspector of Fertilizers.

SIXTH ANNUAL REPORT ON FERTILIZERS.

Gentlemen, — The results of the examination of commercial fertilizers during the past year have been, on the whole, quite satisfactory. From fifty to sixty articles used for fertilizing purposes within our own State have been tested. The analytical statements regarding their chemical composition form the principal portion of my annual report, which I have the honor to present herewith, in conformity with our State law, presented on pp. 312, 313.

The majority of our standard fertilizers sold the past year compare favorably, as far as their composition and their mechanical condition are concerned, with their namesakes of previous years. Some manufacturers of nitrogenous phosphates and superphosphates have added potash to their articles to render them more complete, and thereby increase their chances of a successful application in the field. The number of different brands of fertilizers has for the same reason, of late, shown a material increase. The late general tendency among manufacturers has apparently been to produce articles varying in cost from thirty-five to forty-five dollars per ton of two thousand pounds, at their works: higher-priced articles are still rather the exception than the rule. This feature in our fertilizer trade is, no doubt, largely due to two causes.

First, Most farmers are better informed regarding the mode of applying a fertilizer of a moderate strength than strong chemicals, and prefer it still as the safer material to secure satisfactory results.

Second, Many farmers, being but little familiar with the peculiar character of the essential constituents of chemical fertilizers, are not prepared to discriminate properly between low-priced or high-priced articles and their relative cheapness, taking a low cost and cheapness for synonymous terms. The market-price of nitrogen, phosphoric acid, and potassa

in their various forms, has changed permanently but little during the past year. The market records of Boston and New York at the beginning of the year, the period when the largest bulk of fertilizers for the ensuing season is usually manufactured, have been adopted as the basis of the valuation carried out within this report.

The alteration of our laws for the regulation of the sale of commercial fertilizers, suggested in my previous report (V.), and indorsed by this Board, has since received, as far as the most essential points are concerned, the support of the legislative authorities of the State. The laws of 1874 have been repealed, and new laws, embodying an essential portion of the desired changes, have been in active operation since the 15th of May, 1878. As the changes are practically confined to the first two sections of the previous laws, I enter here on record those sections of the enactments of 1874 which have been greatly altered, and state subsequently the new law in full for the benefit of farmers and dealers.

[Chap. 206.]

An Act concerning Commercial Fertilizers (1874).

Be it enacted, &c., as follows: —

Section 1. Every commercial fertilizer offered for sale within this Commonwealth shall be accompanied by an analysis stating the percentage therein of nitrogen, of anhydrous potassium oxide, or its equivalent of potassium, in any form or combination soluble in distilled water, and of phosphoric oxide or anhydrous phosphoric acid in any form or combination soluble in a neutral solution of citrate of ammonia at a temperature not exceeding a hundred degrees Fahrenheit; the percentage of phosphoric oxide not soluble as above shall also be stated in said analysis, together with the material from which it is obtained: *provided*, that no analysis shall be required for packages of fertilizers which are sold, offered, or exposed for sale, at a less rate than fifteen dollars per ton, or which contain none of the above constituents. A copy of the analysis required shall accompany every parcel sold, offered, or exposed for sale.

Sect. 2. Every manufacturer or importer of commercial fertilizers as specified in Sect. 1, before offering the same for sale in this Commonwealth, shall take out a license as a manufacturer or importer, and pay into the treasury of the Commonwealth fifty dollars annually as a license-fee for each kind of fertilizer so offered, and shall at the same time file with the Secretary of the State Board of Agriculture a paper giving the names of his principal agents, and also the name and composition of the fertilizer manufactured or imported by him.

THE LAWS OF THE STATE PASSED IN 1878 FOR THE REGULATION OF THE TRADE IN COMMERCIAL FERTILIZERS.

[Chap. 258.]

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows: —

SECTION 1. Every lot or parcel of commercial fertilizer sold, offered, or exposed for sale, within this Commonwealth, shall be accompanied by a printed label which shall state clearly the composition of the same, as follows; to wit: In the case of all fertilizers which are sold at more than *twelve dollars per ton, and which contain nitrogen, potassium, or phosphorus, the said label shall give the percentage of anhydrous potassium oxide, or its equivalent of potassium, and of phosphoric oxide or anhydrous phosphoric acid, in any form or combination soluble in distilled water, and the percentage of nitrogen in the fertilizer which it accompanies. In the case of those fertilizers which consist of other and cheaper materials, the said label shall give a correct general statement of the composition and ingredients of the fertilizer it accompanies.*

SECT. 2. *Every manufacturer or importer of commercial fertilizers as specified in Sect. 1, before offering the same for sale in the* Commonwealth, *shall procure a license as a manufacturer or importer* of the same, and shall pay into the treasury of the Commonwealth the *sum of fifty dollars annually as a license-fee;* and shall at the same time file with the secretary of the State Board of Agriculture a paper giving the names of his principal agents and also the name and composition of the fertilizer or fertilizers manufactured or imported by him. *Such license shall entitle the person to whom it is issued to sell and offer for sale only one distinct kind of fertilizer; but such person shall be entitled to sell any other kind of fertilizer upon the payment into the treasury of the Commonwealth an additional license-fee of fifteen dollars for each such additional kind.*

SECT. 3. *Any person selling, offering, or exposing for sale any commercial fertilizer without the statement required by the first section of this act,* or *with a label stating that said fertilizer contains a larger percentage of any one or more of the constituents mentioned in said section than is contained therein, or respecting the sale of which all the provisions of Sect. 2 have not been fully complied with, shall forfeit fifty dollars for the first offence and a hundred dollars for each subsequent offence.*

SECT. 4. The chemist of the State Board of Agriculture shall be *ex officio* a member of said Board, and State Inspector of Fertilizers. It shall be the duty of said inspector annually to analyze one or more specimens of every kind of commercial fertilizer coming within the provisions of this act which may be offered for sale within this Commonwealth, and of the existence of which he shall be informed by the secretary of the Board of Agriculture; and for this purpose he is authorized and directed to take from any package or packages of said fertilizers which may be in the possession of any dealer a sample not exceeding one pound in weight. He shall report annually to the State Board of Agriculture the result of

his inspection, and the analysis made by him, and furnish to the secretary of said Board such important information in regard to commercial fertilizers as he shall from time to time obtain.

SECT. 5. The fee of the State Inspector of Fertilizers shall be twenty-five dollars for each analysis made by him or under his direction, and travelling expenses, to be paid from the treasury of the Commonwealth on the certificate of the State Board of Agriculture; *provided* that no larger sum shall be paid for such services each year than is paid into the treasury of the State for license-fees as provided in Sect. 2.

SECT. 6. It shall be the duty of said inspector, upon ascertaining any violation of this act, to forthwith inform the manufacturer and secretary of the State Board of Agriculture, in writing, thereof; and it shall be the duty of said secretary to immediately institute proceedings against all parties violating this act.

SECT. 7. The license required by Sect. 2 shall be issued by the secretary of the Commonwealth in the manner provided by chapter three hundred and thirty-one of the Acts of the year one thousand eight hundred and seventy.

SECT. 8. Chapters two hundred and six and three hundred and seventy-eight of the Acts of the year one thousand eight hundred and seventy-four are hereby repealed.

SECT. 9. This act shall take effect upon its passage.

Approved May 15, 1878.

The principal changes introduced into the new laws, as compared with those of previous years, may be summed up as follows: —

First, To subject, as far as practicable, a large class of cheaper fertilizers to the regulations of the trade by making twelve dollars per ton the limit.

Second, To oblige all manufacturers of fertilizers containing phosphoric acid to make a *more conspicuous distinction* in their analytical statements between phosphoric acid *soluble in water* and the so-called *reduced* or *reverted* phosphoric acid, soluble in a *solution of citrate of ammonia*, rendering, thereby, the *comparative commercial and agricultural value of different brands* of fertilizers *more prominent*.

Third, To reduce the expenses for licenses in those cases where a manufacturer offers more than one brand of a fertilizer for sale in the general market.

Fourth, To make dealers strictly responsible for the sale of unlicensed articles used for fertilizing purposes. The effect of these changes, it is confidently hoped, will work for the benefit of all parties concerned.

Ruling Market-Prices for the Year 1878–79.

I.

	Price per pound, in cents.
I. *Nitrogen.* In form of ammonia and nitric acid . . .	24
In form of dried ground meat and blood, finely-pulverized steamed bones, finely-ground fish-guano, Peruvian guano, urates, poudrettes, and artificial guano .	20
In form of finely-ground bones, fine-ground horn, wool-dust, bat-guano, &c.	18
In form of coarsely-ground bones, horn-shavings, and woollen rags, human excretions and barnyard-manure, fish-scraps, animal refuse-matter from glue factories and tanneries, &c.	15
II. *Phosphoric Acid soluble in water.* As contained in alkaline phosphates and superphosphates	12.5
In Peruvian guano and urates	9
In form of so-called reduced or reverted acid . .	9
In precipitated bone-phosphate, steamed fine bones, fish-guano, according to size and disintegration, from .	6 to 7
In form of bone-black waste, wood-ash, Caribbean guano, ground bone-ash, coarsely-ground bones, poudrette, barnyard-manure, &c	5
In form of finely-ground South-Carolina and Nevassa phosphates	3.5
III. *Potassium Oxide.* In form of muriate of potash or chloride of potassium	4.5
In form of sulphate of potassa in natural and artificial kainits	6 to 6.5
In form of higher grades of sulphate of potassa . .	7.5 to 9

II.

NAME OF MATERIAL.	Price per ton of 2,000 pounds, in dollars.	Price per pound in case of from 100 to 200 pounds, in cents.
Sulphate of Ammonia, containing from 24 to 25 per cent of ammonia	90–95	4–5
Nitrate of Soda (Chili saltpetre), containing 95 per cent of that compound . . .	75–78	4–4.5
Nitrate of Potassa, containing 94 to 96 per cent of that compound	165–170	9–9.5
Dried Blood, yielding from: —		
(*a*) 12 to 14 per cent of ammonia . .	50	2.5–3
(*b*) 10 to 12 per cent of ammonia . .	45	2.8
Dried Meat, yielding from 14 to 15 per cent of ammonia	50	3

NAME OF MATERIAL.	Price per ton of 2,000 pounds, in dollars.	Price per pound in case of from 100 to 200 pounds, in cents.
Fine-ground Bones, containing from 22 to 24 per cent phosphoric acid, and yielding from 3.5 to 4.5 per cent of ammonia .	35–40	2.5
Bone-black (waste material), containing from 30 to 34 per cent of phosphoric acid .	28–30	1.5
Superphosphate of Lime, containing from 15 to 16 per cent of soluble phosphoric acid .	32–35	2
No. 1 *Peruvian Guano* (Standard or Guanape), containing from 12 to 15 per cent of phosphoric acid, 10 per cent of ammonia, 2 to 3 per cent of potash	56–50	3
No. 1 *Peruvian Guano* (Lobos), containing from 6 to 7 per cent of ammonia, 15 to 20 per cent of phosphoric acid, 3 to 5 per cent of potash	47–50	2.5
No. 1 *Peruvian Guano* (guaranteed), containing:—		
Cargo B, 11.50 per cent of ammonia, 17.10 per cent of phosphoric acid, 2.30 per cent of potash	70	7.4
Cargo F, 6.30 per cent of ammonia, 18.70 per cent of phosphoric acid, 3.20 per cent of potash	56	5.9
No. 1 *Peruvian Guano* (rectified), containing:—		
Cargo —, 9.70 per cent of ammonia, 14.25 per cent of phosphoric acid, 2 per cent of potash	69	7.3
Cargo —, 3.40 per cent of ammonia, 16.90 per cent of phosphoric acid, 3.40 per cent of potash	51	5.4
No. 2 *Peruvian Guano*, containing 3 per cent of ammonia, 15 per cent of phosphoric acid, 2 per cent of potash . . .	38	4
Muriate of Potash, containing from 80 to 85 per cent of that compound, equal 50 to 53.7 per cent of potassium oxide . .	45–48	3
Muriate of Potash (Douglasshall), containing 80 per cent of that compound, equal to 50 per cent of potassium oxide and about 10 per cent of sulphate of magnesia . .	45	2.5
Sulphate of Potassa, containing 80 per cent of that compound, which is equal to 43.3 per cent of potassium oxide . . .	65	4
Sulphate of Potassa, containing from 60 to 65 per cent of that compound, which is equal to from 32.3 to 35 per cent of potassium oxide	55–60	3.5
Sulphate of Potassa, test 40 to 60 per cent of that compound, equal to 22 to 38 per cent of potassium oxide. Standard contains 50 per cent of sulphate of potassium, equal to 27.5 per cent of potassium oxide .	35	2

NAME OF MATERIAL.	Price per ton of 2,000 pounds, in dollars.	Price per pound in case of from 100 to 200 pounds, in cents.
German Potash Salt, containing from 28 to 32 per cent of sulphate of potassa, which is equal to from 15 to 17.3 per cent of potassium oxide	20–25	1.25
Kainit, low grade, containing 22 to 26 per cent of sulphate of potassa, which is equal to from 11.9 to 14 per cent of potassium oxide	15–18	1
Sulphate of Magnesia (Kieserite), containing 55 per cent of that compound . . .	14–15	0.8
Sulphate of Magnesia (Kieserite), containing from 60 to 70 per cent of that compound,	20–25	1.25–1.50
Fine-ground Gypsum, containing from 95 to 98 per cent of that compound . . .	9–10	0.5

I.

Potash–Salts.

I.

Muriate of Potash.

(D. A. Horton, Northampton, Mass.)

	Per cent.
Moisture lost at 100° C.	2.12
Potassium chloride	82.85
Sodium chloride	15.03

II.

Muriate of Potash.

(H. Phelps, Northampton, Mass.)

	Per cent.
Moisture lost at 100° C.	3.00
Potassium chloride	82.00
Sodium chloride	15.00

III.

Muriate of Potash.

(H. Hawes, Boston, Mass.)

	Per cent.
Moisture lost at 100° C.	2.00
Potassium chloride	84.92
Sodium chloride	13.08

IV

Muriate of Potash.

(H. Hawes, Boston, Mass.)

	Per cent.
Moisture lost at 100° C.	2.50
Potassium chloride	93.48
Sodium chloride	4.02

The three first-mentioned samples represent the current quality of muriate of potash; the fourth is of an exceptionally high grade. The annual consumption of this particular kind of potash-salt is steadily increasing. A Boston importer sold during the past season eight thousand bags, and expects to double this amount during the coming season.

Muriate of potash sold at forty-five dollars per ton, or four and five-tenths cents per pound of potassium oxide.

Sulphate of Potassa.

(Messrs. W. H. Bowker, & Co., Boston, Mass.)

	I. Per cent.	II. Per cent.
Potassium oxide	36.11	32.34
Sodium oxide	8.50	7.31
Sulphuric acid	49.82	44.78
Moisture lost at 100° C.	.80	.25
Insoluble matter	1.06	.74

These samples are fair specimens of the larger portion of the high grade sulphates of potassa at present offered in our markets: they are home-manufactured articles, and contain from eight to nine per cent of free sulphuric acid. Their strong acid re-action requires particular care in their application. A careful mechanical distribution and an early application to the soil are the safest means to prevent an injurious influence on young plants. Oversight in either direction is known to cause disappointments.

The experience of German experimenters tends to prove, that, as a general rule, the most satisfactory results are obtained by incorporating the potash-salt into the soil during the autumn; only in the case of a light and sandy soil, which at the same time is quite free from lime and magnesia, do they advise their application in the early part of spring.

Their views are well supported by the known mutual physical and chemical re-action of the majority of soils on potash-salts and their usual saline admixtures.

Nitre-Salt Cake.

	I. Per cent.	II. Per cent.
Moisture lost at 100° C.	5.34	6.71
Potassium oxide	Trace.	.87
Sodium oxide	26.4	32.72
Sulphuric acid	48.85	46.69
Nitric acid	–	8.80
Insoluble matter, sand, &c.	4.12	3.73

Sample No. I. was collected at the store of G. C. Clark of Northampton, Mass.: it has been sold at fourteen dollars per ton. No. II. was obtained from a party in New Haven, Conn. Both substances are refuse salines from the manufacture of nitric acid by means of Chili saltpetre, or crude sodium nitrate and sulphuric acid. Their strong acid re-action renders them valuable as absorbers of ammonia in stables: they are, therefore, best applied either as admixtures to liquid barnyard-manure, or periodically scattered over manure or compost heaps to prevent the loss of nitrogen. Deprived of their acid re-action, they may serve, on account of their large amount of sulphuric acid, as an efficient addition to manures for the production of leguminous crops.

Refuse Salt from Saltpetre-Works.

(Messrs. Bagg & Batchelder, Springfield, Mass.)

	Per cent.
Moisture lost at 100° C.	2.46
Chloride of sodium	60.61
Chloride of potassium	30.39
The latter is equal to potassium oxide	19.20

Valuation per ton of two thousand pounds: —

384 pounds of potassium oxide at 4.5 cents per pound, $17.28.

Refuse salines like the above are no doubt quite valuable as special fertilizers for the production of forage-crops as well as of grain-crops like barley, rye, or buckwheat. They ought, however, not to be used for the growing of tobacco, or sugar-bearing plants, on account of their large amount of chlorine.

Nova-Scotia Plaster.

(Messrs. Crafts Brothers, Whately, Mass.)

	Per cent.
Ground gypsum	91.68
Insoluble matter	1.50
Moisture lost at 100° C.	7.82

Ground gypsum sells at from nine to ten dollars in our section of the country. The sample tested was of good average quality as far as composition and mechanical conditions are concerned.

Crude Sulphate of Magnesia (Kieserite).

(Messrs. W. H. Bowker & Co. Boston, Mass.)

	Per cent.
Moisture lost at 100° C.	20.80
Magnesium oxide	18.75
Calcium oxide	1.44
Sulphuric acid	36.34
Sand, &c.	8.50
Magnesium chloride	2.20

The sample tested is a fair article of its kind. The kieserite quite deservedly enters more every year into our agricultural experiments, partly as an absorber of ammonia in place of gypsum, partly as an additional ingredient of fertilizers for special purposes: its efficiency as a distributer of potash within the soil seems to be less appreciated.

Limekiln-Ashes.

(Sample sent on for examination.)

	Per cent.
Phosphoric acid	3.16
Potassium oxide	Trace.
Carbonate of lime	89.52
Moisture, &c.	.20
Insoluble matter, sand, &c.,	–

The material which is offered for sale under the above name consists, frequently, mainly of air-slacked lime, with but traces of phosphoric acid and potassa, which are the most valuable constituents of wood-ashes. The large amount of phosphoric acid found in the above-described sample of limekiln-ash is an exceptional one, and may be due to some inci-

dental access of a bone. Fair samples as they have been sold from time to time in our vicinity are not worth more than air-slacked lime: they contained from seven hundred and fifty to nine hundred pounds of calcium oxide or lime. The weight of a bushel varied, mainly in consequence of more or less moisture, from forty-four pounds to sixty-three pounds: it is, for this reason, best to buy it by measure instead of by weight. From thirty-three to thirty-five cents have been charged for the bushel of limekiln-ashes.

Gas-House Lime.

(Sent on for Examination.)

	Per cent.
Moisture lost at 100° C.	11.01
Calcium oxide	45.80
Total amount of sulphur present	8.29
Insoluble matter, sand, &c.	3.51

In a former report (IV. Rep., 1876–77) I discussed somewhat in detail the circumstances which control the composition, and thus the value, of the gas-house lime, as well as the proper treatment the latter has to undergo before it can be safely applied for agricultural purposes. In comparing the above-described sample with those mentioned in the report referred to, there is one point of difference in their composition which deserves particular attention when speaking of their relative agricultural value; namely, the amount of sulphur found in the above specimen is four times as large as in either of the previously reported samples, — a fact which furnishes a good illustration regarding the degree of differences which may be noticed in the value of gas-house lime from different gas-manufacturing establishments.

The Vitative Compound; or, Seed and Plant Invigorator.

(Wangaman & Co., Blairsville, Penn.)

The sample tested was obtained from President W. S. Clark, Amherst, Mass.

	Per cent.
Organic and volatile matter	40.70
Ash constituents	59.30
Moisture lost at 100–105° C.	25.67
Oxide of lead in ash	31.11
Oxide of zinc	12.23
Sulphuric acid	14.09

This remarkable article was contained in a strong red paper box about three inches long and one inch and one-quarter wide. Part of the material had been previously taken out. Besides the above-stated name, the following information was printed upon the sides of the box: —

"This compound is purely chemical in its character and effects, containing in a condensed form those ingredients so generally deficient in the soil, and yet so essential to the immediate and certain germination of the seed and the rapid growth of the plant.

"DIRECTIONS FOR USE.

"Dissolve this material in sufficient water to immerse 'half bushel' of seed (corn, wheat, &c.); then add the seed, and allow it to soak for thirty-six or forty-eight hours; then, for 'Garden Seed,' use a teaspoonful of the compound dissolved in a pint of water, allowing the seed to soak twelve to fifteen hours before using it. It is poisonous to animals. Price $1.00. Patented April 21, 1874."

The material tested proved to be a mixture of coarse crystals of sugar of lead (acetate of lead) and sulphate of zinc, or white vitriol. Grinding to a fine powder changes the dry article into a wet mass, in consequence of a partial transformation into sulphate of lead and acetate of zinc. The same change takes place when treated with water; yet the action is more thorough in the latter case. As the sulphate of lead is practically insoluble in water, only a part of the compound can enter into solution, namely, the acetate and the sulphate of zinc in our case; whilst the lead sulphate remains largely suspended in the fresh solution as an impalpable powder. The claims of the manufacturer need no comment. The article, if carefully used, may act beneficially on seeds infected with the germs of parasites, in destroying their life in many instances, and acting thus similar to a diluted solution of sulphate of copper, which, in Germany, quite frequently is used with good effect for that purpose. A few cents will pay, in either case, for the amount of material required.

Nitrate of Soda (Chili Saltpetre).

	I. Per cent.	II. Per cent.
Moisture lost at 100° C.	1.00	1.94
Chlorine	2.52	.35
Calcium oxide	.41	Trace.
Sand, ferric oxide	.24	.80
Sulphuric acid	–	.20
Sodium nitrate	94.00	97.00

No. I., from Messrs. Bowker & Co., Boston, Mass., was of reddish-white color, and a distinct, coarse crystallization. No. II. was collected of H. Phelps, Northampton, Mass. It was of the usual grayish-white color, and of good crystallinic condition. It represents, to some extent, the variation which we notice in our markets. One ton sold, at the beginning of the season, at seventy-five dollars, or twenty-four cents per pound of its nitrogen. The manufacture of this article is, as is well known, under government control, and its guaranteed average composition is usually stated as follows: —

	Per cent.
Sodium nitrate	95.00
Sodium chloride	2.50
Sodium sulphate, &c.	.50
Moisture	2.00
	100.00

The prospects of an ample supply of this saline for many years are very encouraging, as may be inferred from the following statement: —

Along the Pacific coast of South America, extending from the fourth to the fortieth degree of south latitude, about twenty-four hundred miles along the slope of the Andes to the sea, in Bolivia, Peru, and part of Chili, there has been found a line of deposits of sodium nitrate, commonly called Chili saltpetre. The existence of such deposits in Southern Peru — Atacama — had been known for many years previous to the discovery of their extension into Bolivia and Chili. The dry soil of the larger portion in these rainless sections of those countries is pervaded in some degree with these deposits. The beds are varying in thickness, and are covered with from one to ten yards' depth of earth or half-formed sandstone. The material of which they are composed is called by the natives "caliche," and it contains from fifty to seventy-five per cent of sodium nitrate. It is estimated that the quantity of this saline compound in the Province of Tarapaca alone, within an area of fifty square leagues, is not less than sixty-three million tons. The annual production of the sodium nitrate is for the present limited, by the decision of the governments, to five million quintals, or to from forty-four to forty-five

thousand tons, of which about one-fourth is consumed in Germany.

As an intelligent review of the results obtained elsewhere after some years of actual trials in the field cannot be without interest to farmers, considering our present early stage of experimental inquiry into the merits of the nitrate of soda for the production of crops, I introduce here a short abstract from an interesting paper recently published, "On the Proper Use of Chemical Fertilizers," by Professor M. Maercker of Halle, Germany, adding such statements as may aid in a due appreciation of the subject under discussion. The nitric-acid-containing salines excel in rapidity and intensity of action all other nitrogen-containing substances. The Chili saltpetre assists in a high degree in the diffusion of potassa and phosphoric acid throughout the entire body of the soil. Its application as a fertilizer tends to produce larger plants with a more extended root-system, and causes thus an increased consumption of all the principal articles of plant-food. As *no single article of plant-food can for any length of time cause good crops*, it becomes an essential condition for the continued successful cultivation of any of our farm-crops to use it, as a general rule, with a liberal amount of potash and phosphoric acid.

A repeated treatment of the soil with Chili saltpetre, without restoring those mineral plant-constituents which the crops largely consume, and of which the former contains but small quantities in an available form, is consequently a ruinous practice, and excusable only in exceptional cases. A liberal use of this saline compound, or nitrogen compounds in general, tends to extend the period of vegetation, and thus to retard the ripening process. *The later in the season the sodium nitrate is applied, the more serious is its effect on the extension of the period of growth, and the more imminent the danger of obtaining unripe crops.* An excessive amount of straw, and a small yield of grain, in case of our cereals, and large watery roots deficient in sugar, and such constituents as are formed during the later period of growth, — in unfavorable seasons in particular, — are quite frequent but practical illustrations of this mode of action. A repeated *late application of the sodium nitrate as top-dressing* intensifies, for obvious reasons, the previously stated tendency of

retarding the ripening process: in the case of the sugar-beet root this effect is simply ruinous, and therefore that mode of operation is ruled out in that branch of agricultural industry. This feature of its action, once duly recognized, furnishes the key to a proper understanding of many contradictory reports and opinions regarding its merits as a most valuable nitrogen source in general and special farm-industry. To secure its very efficient property, to stimulate a luxuriant and vigorous growth unimpaired, requires as the first condition of success an early application.

As phosphoric acid is known to hasten the ripening process, and thus tends by its action to shorten the period of vegetation, it is a good practice to use the nitrate, in connection with a liberal amount of that acid in some available form, to produce large crops of a *good quality.* The Chili saltpetre, favoring rapid growth, produces usually, in case of grain-crops, stems with long thin internodes, which are liable to lodge. To counteract this tendency, an excess of seed ought to be avoided, and a cultivation in wide drills be adopted to improve the chances of a healthy development of each individual plant. In case of the cultivation of beet-roots for sugar manufacture, where small roots are more valuable, a liberal use of this saline manure decidedly promotes that object, provided a fair amount of good seed has been used. The Chili saltpetre excels in a light or sandy soil every other nitrogen compound in efficiency: in heavy soils its effect is less pronounced. The best results have been obtained upon a deep humus containing loam.

Some of the most successful cultivators of beet-roots in Germany apply, in the latter case, by deep ploughing, one-half of the amount of the nitrate they wish to use during the autumn, the rest at an early date in the following spring. Its peculiar binding action on the soil renders a thorough cultivation essential to retain it in a mellow condition. Although its indirect beneficial re-action on the soil as a diffuser of phosphoric acid and potash, and also as a promoter of its hygroscopic quality, is by no means small, its positive merits as a source of nitrogen for a healthy and vigorous plant-growth are most conspicuous, and deserving a careful consideration and trial on the part of intelligent farmers. For various reasons it would be best to buy the

article without any admixture, and to apply it at an early date in the spring, in common with other soluble fertilizing materials, as superphosphates, &c., by sowing it broadcast, and ploughing it in a few inches deep. Fine-ground bones incorporated during the fall with from seventy-five to one hundred and fifty pounds of Chili saltpetre, according to requirements, and applied as an early top-dressing in the following spring, have given excellent results. Winter and summer grain-crops, annual and perennial fodder-crops, leguminous plants and hoed crops, have been successfully treated with it. The peculiar character of this fertilizer requires a careful proceeding to arrive at correct conclusions.

Sulphate of Ammonium.

(H. Phelps, Northampton, Mass.)

	I. Per cent.	II. Per cent.
Moisture lost at 100° C.	4.34	10.78
Ammonia	24.00	24.84
Sulphuric acid	58.92	59.19
Sand, &c.	Trace.	.04

Both samples were of good quality, and fair representatives of our home manufacture. Their different odor indicated their different source. One was of the usual bluish-white color, and evidently obtained from the ammoniacal watery product of the coal-gas manufacture: the other was of a white color, and smelled like the product of the dry destructive distillation of animal matter. The demand for this efficient nitrogen compound is at present, for obvious reasons, much larger than its supply. The price per ton at the beginning of the late season was ninety dollars, or five cents and a half per pound in the retail trade, with a guaranty of twenty-five per cent of ammonia.

Dried Blood.

(W. Peters, Baltimore, Md.)

	Per cent.
Volatile and organic matter	94.37
Ash constituents	5.64
Moisture at 100° C.	21.52
Nitrogen	10.99

Dried Blood.

(Messrs. W. H. Bowker & Co.)

	I. Per cent.	II. Per cent.
Volatile and organic matter	96.44	89.96
Ash constituents	3.56	10.04
Moisture at 100° C.	13.47	12.58
Nitrogen	12.93	11.66
Phosphoric acid	–	2.04
Insoluble matter, sand, &c.	–	.92

This convenient and valuable form of nitrogen is largely used for the preparation of concentrated fertilizers according to prescribed formulæ for specified crops.

Dry blood of the above-stated high quality has been sold at fifty dollars per ton, or twenty cents per pound of nitrogen.

Ground Horn and Hoof.

(Sent on for examination.)

	Per cent.
Moisture lost at 100° C.	10.08
Organic and volatile matter	85.38
Ash constituents	14.62
Total nitrogen	11.84
Total phosphoric acid	2.30
Insoluble matter	.24

The substance was in an excellent mechanical condition, and evidently in a good state of disintegration for speedy action. This condition is brought about, as I have stated already on a previous occasion, by subjecting the crude material for some time to high pressed steam, and subsequent rapid and thorough drying at somewhat above 100° C.

Wool-Waste.

(Sent on for examination.)

	Per cent.
Moisture lost at 100° C.	10.12
Nitrogen	5.10

The material tested had been exposed for nearly one year to the unrestricted influence of the weather, with apparently but little effect: its low percentage of nitrogen is due to foreign admixture, as sweepings, &c. The agricultural value

as well as the proper treatment of wool-waste was discussed in my fourth report, to be found in Flint's Report for 1876, p. 254, to which I refer parties interested.

Bat-Guano.

(Sent on for examination, from Galveston, Tex.)

	Per cent.
Organic and volatile matter	77.33
Ash constituents	22.67
Moisture lost at 100° C.	21.15
Total nitrogen	7.14
Phosphoric acid	6.53
Insoluble matter, sand, &c.	.95

Valuation per ton of two thousand pounds:—

142.8 pounds of nitrogen at 18 cts. per pound	$25 70
130.6 pounds of phosphoric acid, 5 cts. per pound	6 53
	$32 23

The bat-guano deposits of Texas, referred to in my report of 1876–77, as well as the one from which the above sample was obtained, consist evidently of a valuable material, and deserve particular attention. Judging from communications lately received from the owners of some of these deposits, their importance for the development of Southern special agricultural interests, as cotton, sugar-cane, and rice cultivation, begins to be appreciated. The prospects are, that hereafter but small quantities will find their way into our Northern markets.

Castor-Bean Pomace.

(Sent by Hon. Charles L. Flint, Boston, Mass.; obtained from works in St. Louis, Mo.)

	Per cent.
Moisture lost at 100° C.	9.25
Nitrogen	5.33
Phosphoric acid	2.03
Potassium oxide	.64
Calcium oxide	.96
Magnesium oxide	.37
Sand, &c.	2.38

Valuation per ton of two thousand pounds:—

106.6 pounds of nitrogen at 18 cts. per pound	$19 19
40.6 pounds of phosphoric acid	2 44
12.8 pounds of potassium oxide	1 77
	$22 40

The composition of this material depends, to a considerable extent, on the degree in which the oil has been removed: the same rule applies to the rate of its action as a fertilizer. The percentage of nitrogen is reported as high as 7.33 per cent. The wholesale price is at present about eighteen dollars in the New-York and Boston markets. Large quantities have been sent for years to England. Its good qualities as a fertilizing material begin to be understood at home; and considerable quantities are sold at our Atlantic seaport towns for home consumption. The pomace ought to be at once ploughed under. The best time is in the fall.

I.

Fine-ground Fish.

(Sample sent on by a dealer in Boston.)

	Per cent.
Organic and volatile matter	81.58
Ash constituents	18.42
Moisture lost at 100° C.	14.95
Phosphoric acid in ash	6.97
Nitrogen in organic matter	8.16
Fat in total matter	9.16
Sand, &c.	1.53

Valuation per ton of two thousand pounds: —

139.4 pounds of phosphoric acid	$6 96
163.2 pounds of nitrogen	32 64
	$39 61

II.

Fine-ground Fish.

(Collected of H. Phelps, Northampton, Mass.)

	Per cent.
Organic and volatile matter	79.27
Ash constituents	20.73
Moisture lost at 100° C.	22.00
Phosphoric acid in ash	8.90
Nitrogen in organic matter	6.93
Sand, &c.	.83

Valuation per ton of two thousand pounds: —

178 pounds of phosphoric acid	$8 90
138.6 pounds of nitrogen	27 72
	$36 62

III.

Fine-ground Fish.

(Bradley Fertilizer Co., Boston, Mass.)

	Per cent.
Organic and volatile matter	80.42
Ash constituents	19.58
Phosphoric acid in ash	7.41
Nitrogen in organic matter	7.71

Valuation per ton of two thousand pounds: —

148.2 pounds of phosphoric acid	$7 41
154.2 pounds of nitrogen	30 84
	$38 25

IV.

Half-dry Fish.

(Quinnipiac Co., D. A. Horton, Northampton, Mass.)

	Per cent.
Organic and volatile matter	90.58
Ash constituents	9.42
Moisture lost at 100° C.	50.12
Phosphoric acid	4.48
Nitrogen	6.02
Sand, &c.	1.06

Valuation per ton of two thousand pounds: —

120.4 pounds of nitrogen	$24 08
89.6 pounds of phosphoric acid	5 38
	$30 46

Sediment from Water coming from Fish-Press.

(Specimen sent on for examination.)

	Per cent.
Moisture lost at 100° C.	76.54
Residue left at 100° C.	23.46
Nitrogen in residue	1.34
Phosphoric acid in residue	.40

Valuation per ton of two thousand pounds: —

8 pounds of phosphoric acid	$40
26.8 pounds of nitrogen	5 36
	$5 76

The fish-fertilizers which came under my notice during the past year proved to be, in the majority of cases, in a superior mechanical condition as compared with previous years. A large portion of the fish-guano sold was of a more uniform and a better state of dryness. Several more or less successful new modes of abstracting the fat from fish have been introduced, all tending in the end to increase directly or indirectly the nitrogenous constituents of the fish-refuse. The results thus far obtained are highly encouraging, and entitle us to the expectation that our fish-fertilizer will soon rank foremost, as far as its percentage of nitrogen is concerned, among our home-made animal nitrogenous phosphates. A Boston agent of a fish-guano manufacturing company announces that he shall have for sale during the coming season, in invoice lots, the *odorless* dried and ground *fish-guano*, testing from 13 to 15 per cent of ammonia (or 10.7 to 12.36 per cent of nitrogen). Apparently successful attempts have also been made of late to convert the heads and backbones of the codfish from our own fisheries into fish-guano similar to the Lofoten-Island fish-guano of the Norwegian fisheries. The composition of this fish-guano at a uniform state of moisture has varied for several years within but narrow limits, — 7.97 to 8.55 per cent of nitrogen, and 13.10 to 13.9 per cent of phosphoric acid. There is every reason to suppose that before long the fish-guano manufactured along the New-England coast will, with reference to quality and to quantity, successfully compete with those most favorably known in the markets of Europe and elsewhere. For economical reasons, it is advisable for farmers to consider whether, in some instances, an addition of phosphoric acid to our best quality of fish-guano would not render the large amount of its nitrogen more remunerative. To buy the best is the safest practice, as long as nitrogen and phosphoric acid are charged alike in low and high graded articles at a customary market-price.

Abstract from the Report of the United-States Menhaden Oil and Guano Association, Jan. 15, 1879.

Amount of capital invested in 1878	$2,350,000
Number of factories in operation in 1878	56
Number of sail-vessels employed in 1878	279
Number of steamers employed in 1878	64
Number of men employed in 1878	3,337
Number of fish caught in 1877	587,624,125
Number of fish caught in 1878	767,779,250
Number of barrels in 1877	1,958,747
Number of barrels in 1878	2,559,264
Number of gallons oil made in 1877	2,426,589
Number of gallons of oil made in 1878 [1]	3,809,233
Number of tons crude guano made in 1877	55,444
Number of tons crude guano made in 1878	83,719
Number of tons guano dried in 1877	5,700
Number of tons guano dried in 1878 [2]	19,377
Number of tons guano held by the manufacturers Jan. 15, 1879	885

Navassa Phosphate.

(Specimen sent on for examination.)

	Per cent.
Moisture lost at 100° C.	5.60
Phosphoric acid	34.45
Calcium oxide	37.22
Ferric oxide	11.79
Sand, &c.	–

Valuation per ton of two thousand pounds: —

689 pounds, at 3.5 cents per pound	$24 12

The value and character of this rich phosphate in fertilizers have been discussed in previous reports. But little of the ground material is used at present with us: it enters largely into the manufacture of superphosphates for the general market. Renewed attempts will most likely be made during the coming season to introduce the Orchilla guano in the New-England States, judging from information received. The friable nature and peculiar pulverulent condition of this phosphate fit it better for direct application, without any previous chemical treatment, than the above-described material.

[1] In 1878 the yield of oil per thousand fish was 4 8-10 gallons.

[2] Dried from the above-stated crude guano.

Bones.

I.

Coarse Bones of P. Cooper, New-York City.

(Hon. R. Goodman of Lenox, Mass.)

	a. Per cent.	b. Per cent.
Organic and volatile matter	27.70	28.59
Ash constituents	72.30	71.41
Moisture lost at 100° C.	5.27	4.95
Nitrogen	2.10	not det.
Phosphoric acid	26.33	29.42
Insoluble matter	4.80	.34

II.

Fine Bones of Messrs. L. B. Darling & Co., Pawtucket, R.I.

(Messrs. Bagg & Batchelder, Springfield, Mass.)

	Per cent.
Organic and volatile matter	47.31
Ash constituents	52.69
Moisture lost at 100° C.	6.45
Nitrogen	3.67
Phosphoric acid	22.30
Insoluble matter, sand, &c.	1.53

III.

Fine Bones of H. B. Arnold, Boston, Mass.

	Per cent.
Organic and volatile matter	32.42
Ash constituents	67.58
Moisture lost at 100° C.	4.98
Nitrogen	2.27
Phosphoric acid	27.41
Insoluble matter, sand, &c.	.64

Nos. I. and IV. are of a similar chemical condition. They are highly rendered, and thus contain less nitrogen and more phosphoric acid than No. II., which is the most valuable article of the samples tested.

A new process has been applied of late for the manufacture of "fine bones," which aims at the removal of the fat of the bones, without reducing their nitrogenous constituents. A Baltimore firm offers "ground bones" which have been subjected to *Adamson's* new *naphtha vapor-process*, and guaran

tees 4.8 per cent of nitrogen with 23.69 per cent of phosphoric acid, — a composition which, it must be conceded, is an exceptionally good one. As the commercial value of bones depends in a considerable degree on their mechanical condition, it is well to take that point into consideration when buying. The best quality of "fine bones" sold at forty dollars per ton; coarse qualities, like No. I., sold at from twenty-eight to thirty dollars per ton.

Animal Guano.

(Manufactured by Messrs. Thompson & Edwards of Chicago, Ill.; collected of H. D. Hubbard of Hatfield, Mass.)

	Per cent.
Organic and volatile matter	61.64
Ash constituents	38.36
Moisture lost at 100° C.	9.00
Total nitrogen	5.09
Total phosphoric acid	12.63
Insoluble matter, sand, &c.	4.50

Valuation per ton of two thousand pounds: —

101.8 pounds of nitrogen	$20 36
252.6 pounds of phosphoric acid	15 16
	$35 52

Animal Fertilizer with Potash.

(Manufactured by Messrs. L. B. Darling & Co., Pawtucket, R.I.; collected of Messrs. Bagg & Batchelder, Springfield, Mass.)

	Per cent.
Moisture lost at 100° C.	9.19
Total nitrogen	5.45
Total phosphoric acid	8.38
Potassium oxide	8.36
Insoluble matter, sand, &c.	1.71

Valuation per ton of two thousand pounds: —

109 pounds of nitrogen	$21 80
167.6 pounds of phosphoric acid	10 06
167.2 pounds of potassium oxide	7 53
	$39 39

The value of this class of fertilizers, which along our highways for Western transportation is largely supplied by Western dealers, is better appreciated than formerly in consequence of years of trial. Its early action on the crops

depends largely on a good fine mechanical condition, — a point which is not always duly considered by dealers and farmers. Animal fertilizers, like bones, act slower than superphosphates, and require an early application to show their influence in the first year. They produce better results, on account of more favorable conditions for their decomposition during the first year, upon a light soil than upon a heavy one: on the other hand, they hold out better the second, and even the third year, — a fact which ought to enter into the calculation of expenses for the production of the crops raised by their assistance. With these peculiarities well understood, they may, on account of their high nitrogen percentage, be counted among our most valuable home-resources of fertilizers.

Peruvian Guano.

I.

Warranted No. I. Peruvian Guano.

(Messrs. Bagg & Batchelder, Springfield, Mass.)

	Per cent.
Moisture lost at 100° C.	11.62
Nitrogen	7.96
Phosphoric acid	13.78
Potassium oxide	3.00
Insoluble matter, sand, &c.	6.07

This article is worth, at customary rates, $60.16.

II.

Rectified Peruvian Guano.

(Manufactured by Messrs. Hobson, Hurtado, & Co., New-York City; and collected of Messrs. W. H. Bowker & Co., Boston, Mass.)

	Per cent.
Moisture lost at 100° C.	11.56
Nitrogen	8.15
Phosphoric acid, total	14.12
Phosphoric acid soluble in water	12.47
Reverted phosphoric acid	.74
Insoluble phosphoric acid	.91
Potassium oxide	1.62
Insoluble matter, sand, &c.	4.33

Valuation per ton of two thousand pounds: —

163 pounds of nitrogen	$32 60
249.4 pounds of soluble phosphoric acid	31 17
14.8 pounds of reverted phosphoric acid	1.33
18.2 pounds of insoluble phosphoric acid	1.09
32.4 pounds of potassium oxide	2.43
	$68 62

The commercial advertisements of the dealers in Peruvian guano contain quite a list of different kinds of the genuine article, varying, for well-known reasons, widely from each other in composition, as may be seen in the price-list of our fertilizers printed in the introduction of this report. They are offered for sale with guaranteed composition, and at acceptable prices at our present rates of valuation. From a mere commercial stand-point, no objection can be raised against the lately adopted system of selling by analysis; for both parties in the transaction accept their respective responsibilities without any further reserve on either side. Looking, however, at the question from an agricultural stand-point, grave doubts must arise, whether, on the whole, the general verdict of farmers regarding the results they obtained in consequence of using Peruvian guano as fertilizers will be as favorable as the dealers may feel entitled to claim, assuming, that, in the majority of cases, the selection made on the part of the farmers has been a judicious one. A simpler mode of classification in the price-lists seems to the writer quite desirable in the interest of a better understanding on the part of the farmer. The introduction of many names, referring to cargoes, &c. (an information of no interest to the practical farmer), and the frequent changing of names referring to the particular locality in Peru whence the article has been obtained (a statement of interest only to a few parties, comparatively speaking, who may be reached as well by some other simple mode of communication), render the present advertisements rather complicated, without bringing the particular information generally needed in a more conspicuous position. Next to the statements of the absolute amount of nitrogen and of phosphoric acid which a genuine guano contains, we are interested to know the relative proportion of these two lead-

ing constituents; for on that particular circumstance depends the decision where and how to turn the various articles to the most economical account. A classification more prominently based on their relative proportion of nitrogen and phosphoric acid, with simpler names for each class, would be both rational and suggestive. That course once adopted would enable us to assign to the various kinds of guano their proper position among our commercial nitrogenous phosphates, which could not fail to turn a more general attention to their respective special fitness for the production of a variety of crops. The variable character of the Peruvian guano of the present day favors the adoption of the principles of classification previously advocated. To establish three standards corresponding approximately to those noticeable with reference to the general character of the nitrogenous phosphates and superphosphates, i.e., one nitrogen to one phosphoric acid, one nitrogen to two or three phosphoric acid, one nitrogen to four or five phosphoric acid, and to maintain them for years, by mixing different cargoes to suit the adopted scale, whatever that may be, seems, for several important reasons, deserving a careful consideration on the part of the importers of the Peruvian guano. The extensive application of some of our standard superphosphates is, to say the least, as much due to the maintaining of a general uniform character during past years as to their peculiar chemical composition. Farmers have learned how, where, and to what extent, to use them to secure paying returns.

The following copy of a recent statement regarding the changes in the consumption of the *Raw Genuine Peruvian Guano*, and of the *Ohlendorf Standard Soluble Peruvian Guano*, described in some of my previous reports, in the Province Saxony of Prussia, during the years from 1866 to 1872, may be, for several reasons, not without interest in this connection.

	Raw Peru. Guano. Tons (2,000 lbs.).	Ohlendorf Sol. Peru. Guano. Tons (2,000 lbs.).
1866	3,331	4,115
1869	1,713	12,292
1872	216	21,522

Ohlendorf's Soluble Guano corresponds with the *Rectified* Peruvian Guano of our dealers, as far as their general character is concerned.

Ammoniated Superphosphates.

I.

Russel Coe's Ammoniated Superphosphate.

(Messrs. J. & J. A. Rice, Worcester, Mass.)

	Per cent.
Organic and volatile matter	49.92
Ash constituents	50.08
Moisture lost at 100° C.	25.42
Total nitrogen	1.90
Total phosphoric acid	18.61
Phosphoric acid soluble in water	2.41
Reverted phosphoric acid	3.99
Insoluble phosphoric acid	12.21
Insoluble matter, sand, &c.	1.94

Valuation per ton of two thousand pounds: —

48.2 pounds of soluble phosphoric acid	$6 03
79.8 pounds of reverted phosphoric acid	7 18
244.2 pounds of insoluble phosphoric acid	14 65
38 pounds of nitrogen	7 60
	$35 46

II.

Enoch Coe's Ammoniated Superphosphates.

(Messrs. Arms & Co., Greenfield, Mass.)

	Per cent.
Organic and volatile matter	60.71
Ash constituents	39.29
Moisture lost at 100° C.	16.30
Total nitrogen	3.01
Total phosphoric acid	14.12
Phosphoric acid soluble in water	10.12
Reverted phosphoric acid	1.23
Insoluble phosphoric acid	2.77
Insoluble matter, sand, &c.	.95

Valuation per ton of two thousand pounds: —

60.2 pounds of nitrogen	$12 04
202.4 pounds of soluble phosphoric acid	25 30
24.6 pounds of reverted phosphoric acid	2 22
55.4 pounds of insoluble phosphoric acid	3 32
	$42 88

III.

Frank Coe's Ammoniated Superphosphate.

(Messrs. J. S. Clark & Sons, Worcester, Mass.)

	Per cent.
Organic and volatile matter	63.61
Ash constituents	36.39
Moisture lost at 100° C.	18.41
Total nitrogen	3.09
Total phosphoric acid	12.24
Phosphoric acid soluble in water	8.28
Reverted phosphoric acid	1.18
Insoluble phosphoric acid	2.78
Insoluble matter, sand, &c.	1.82

Valuation per ton of two thousand pounds: —

61.8 pounds of nitrogen	$12 36
165.6 pounds of soluble phosphoric acid	20 70
23.6 pounds of reverted phosphoric acid	2 12
55.6 pounds of insoluble phosphoric acid	3 34
	$38 52

IV.

Bay-State Ammoniated Superphosphate.

(G. B. Knowlton, Fitchburg, Mass.)

	Per cent.
Organic and volatile matter	63.08
Ash constituents	36.92
Moisture lost at 100° C.	23.65
Total nitrogen	2.61
Total phosphoric acid	9.94
Phosphoric acid soluble in water	8.54
Reverted phosphoric acid	.23
Insoluble phosphoric acid	1.17
Insoluble matter, sand, &c.	1.33

Valuation per ton of two thousand pounds: —

52.2 pounds of nitrogen	$10 44
170.8 pounds of soluble phosphoric acid	21 35
4.6 pounds of reverted phosphoric acid	42
23.4 pounds of insoluble phosphoric acid	1 40
	$33 61

V.

Ammoniated Superphosphate of H. B. Arnold, Boston, Mass.

	Per cent.
Organic and volatile matter	62.46
Ash constituents	37.54

	Per cent.
Moisture lost at 100° C.	23.85
Total nitrogen	2.68
Total phosphoric acid	8.66
Phosphoric acid soluble in water	6.29
Reverted phosphoric acid	.87
Insoluble phosphoric acid	1.50
Potassium oxide	2.05

Valuation per ton of two thousand pounds: —

53.6 pounds of nitrogen	$10 72
125.8 pounds of soluble phosphoric acid	15 73
17.4 pounds of reverted phosphoric acid	1 57
30 pounds of insoluble phosphoric acid	1 80
41 pounds of potassium oxide	1 85
	$31 67

VI.

Manhattan Blood-Guano.

(Messrs. Crafts Brothers, Whately.)

	Per cent.
Organic and volatile matter	63.02
Ash constituents	36.98
Moisture lost at 100° C.	16.74
Total nitrogen	2.90
Total phosphoric acid	14.25
Phosphoric acid soluble in water	9.02
Reverted phosphoric acid	2.26
Insoluble phosphoric acid	2.97
Potassium oxide	.46
Insoluble matter, sand, &c.	1.92

Valuation per ton of two thousand pounds: —

58 pounds of nitrogen	$11 60
180.4 pounds of soluble phosphoric acid	22 55
45.2 pounds of reverted phosphoric acid	4 07
59.4 pounds of insoluble phosphoric acid	3 57
9.2 pounds of potassium oxide	42
	$42 21

VII.

Professor Orth's German Plant-Food.

(G. W. Guy, Boston, Mass.)

	Per cent.
Moisture lost at 100° C.	6.20
Total nitrogen	8.45
Total phosphoric acid	9.04
Phosphoric acid soluble in water	7.40

	Per cent.
Reverted phosphoric acid	.78
Insoluble phosphoric acid	.86
Potassium oxide	8.95
Sand, &c.	.42

Valuation per ton of two thousand pounds:—

169 pounds of nitrogen	$33 80
148 pounds of soluble phosphoric acid	18 50
15.6 pounds of reverted phosphoric acid	1 41
17.2 pounds of insoluble phosphoric acid	1 03
179 pounds of potassium oxide	8 06
	$62 80

VIII.

Pacific Soluble Guano.

(Collected at the warehouse in Boston.)

	Per cent.
Moisture lost at 100° C.	16.85
Total nitrogen	3.04
Total phosphoric acid	14.01
Phosphoric acid soluble in water	7.51
Reverted phosphoric acid	.03
Insoluble phosphoric acid	6.47
Insoluble matter, sand, &c.	6.09
Potassium oxide	.24

Valuation per ton of two thousand pounds:—

60.8 pounds of nitrogen	$12 16
150.2 pounds of soluble phosphoric acid	18 78
.6 pounds of reverted phosphoric acid	06
129.4 pounds of insoluble phosphoric acid	7 76
4.8 pounds of potassium oxide	26
	$39 02

IX.

George Upton's Ammoniated Superphosphate.

(H. Phelps, Northampton, Mass.)

	Per cent.
Organic and volatile matter	53.22
Ash constituents	46.78
Moisture lost at 100° C.	25.96
Total nitrogen	2.17
Total phosphoric acid	9.25
Phosphoric acid soluble in water	3.64
Reverted phosphoric acid	4.18
Insoluble phosphoric acid	1.43
Insoluble matter, sand, &c.	3.13

Valuation per ton of two thousand pounds: —

43.4 pounds of nitrogen	$8 68
72.8 pounds of soluble phosphoric acid	9 10
83.6 pounds of reverted phosphoric acid	7 53
28.6 pounds of insoluble phosphoric acid	1 72
	$27 03

X.

Original Coe's Ammoniated Superphosphate.

(Manufactured by Bradley's Fertilizer Co., Boston; collected of Messrs. J. & J. A. Rice, Worcester, Mass.)

	Per cent.
Organic and volatile matter	60.76
Ash constituents	39.24
Moisture lost at 100° C.	18.19
Total nitrogen	3.17
Total phosphoric acid	15.04
Phosphoric acid soluble in water	10.71
Reverted phosphoric acid	3.38
Insoluble phosphoric acid	.95
Insoluble matter, sand, &c.	2.96

Valuation per ton of two thousand pounds: —

63.4 pounds of nitrogen	$12 68
214.2 pounds of soluble phosphoric acid	26 78
67.6 pounds of reverted phosphoric acid	6 09
19 pounds of insoluble phosphoric acid	1 14
	$46 69

XI.

William L. Bradley's Patent Superphosphate.

(Messrs. J. & J. A. Rice, Worcester, Mass.)

	Per cent.
Organic and volatile matter	60.94
Ash constituents	39.06
Moisture lost at 100° C.	19.24
Total nitrogen	3.12
Total phosphoric acid	12.86
Phosphoric acid soluble in water	8.44
Reverted phosphoric acid	.24
Insoluble phosphoric acid	4.18
Insoluble matter, sand, &c.	2.68

Valuation per ton of two thousand pounds: —

62.4 pounds of nitrogen	$12 48
168.8 pounds of soluble phosphoric acid	21 10
4.8 pounds of reverted phosphoric acid	43
83.6 pounds of insoluble phosphoric acid	5 02
	$39 03

XII.

Matfield's Lawn-Dresser.

(G. W. Guy, Boston, Mass.)

	Per cent.
Moisture lost at 100° C.	9.49
Total nitrogen	1.74
Total phosphoric acid	4.50
Phosphoric acid soluble in water	2.75
Reverted phosphoric acid	.07
Insoluble phosphoric acid	1.68
Potassium oxide	7.16
Insoluble matter, sand, &c.	5.42

Valuation per ton of two thousand pounds:—

34.8 pounds of nitrogen	$6 96
55 pounds of soluble phosphoric acid	6 88
1.4 pound of reverted phosphoric acid	13
33.6 pounds of insoluble phosphoric acid	2 02
143.2 pounds of potassium oxide	8 59
	$24 58

XIII.

Russel Coe's Ammoniated Superphosphate.

(Messrs. Whittemore Brothers, Boston, Mass.)

	Per cent.
Organic and volatile matter	51.52
Ash constituents	48.48
Moisture at 100° C.	20.91
Total nitrogen	2.40
Total phosphoric acid	17.31
Phosphoric acid soluble in water	4.61
Reverted phosphoric acid	3.59
Insoluble phosphoric acid	9.11
Insoluble matter, sand, &c.	–

Valuation per ton of two thousand pounds:—

48 pounds of nitrogen	$9 60
92.2 pounds of soluble phosphoric acid	11 53
71.8 pounds of reverted phosphoric acid	6 46
182.2 pounds of insoluble phosphoric acid	10 93
	$38 52

XIV.

Stockbridge Manures; Hungarian Grass.

(Messrs. W. H. Bowker & Co., Boston, Mass.)

	Per cent.
Moisture lost at 100° C.	15.92
Total nitrogen	7.92

	Per cent.
Total phosphoric acid	2.36
Phosphoric acid soluble in water	1.43
Reverted phosphoric acid	.15
Insoluble phosphoric acid	.78
Potassium oxide	8.03
Insoluble matter, sand, &c.	.68

Valuation per ton of two thousand pounds: —

158.4 pounds of nitrogen	$31 68
28.6 pounds of soluble phosphoric acid	3 58
3 pounds of reverted phosphoric acid	27
15.6 pounds of insoluble phosphoric acid	94
160.6 pounds of potassium oxide	7 23
	$43 70

XV.

Stockbridge Manures; Tobacco.

(H. C. Comins, Northampton, Mass.)

	Per cent.
Moisture lost at 100° C.	8.75
Total nitrogen	6.65
Total phosphoric acid	2.55
Phosphoric acid soluble in water	1.88
Insoluble phosphoric acid	.67
Potassium oxide	9.36
Magnesium oxide	.67
Calcium oxide	7.10
Insoluble matter, sand, &c.	1.52

Valuation per ton of two thousand pounds: —

133 pounds of nitrogen ($\frac{2}{3}$ is actual ammonia)	$29 92
37.6 pounds of soluble phosphoric acid	4 70
13.4 pounds of insoluble phosphoric acid	80
187.2 pounds of potassium oxide	14 04
	$49 46

XVI.

W. H. Bowker's Hill and Drill Phosphate.

(H. C. Comins, Northampton, Mass.)

	Per cent.
Organic and volatile matter	66.81
Ash constituents	33.19
Moisture lost at 100° C.	19.70
Total nitrogen	3.22
Total phosphoric acid	10.62
Phosphoric acid soluble in water	8.47
Reverted phosphoric acid	1.41
Insoluble phosphoric acid	.74
Insoluble matter, sand, &c.	1.99

Valuation per ton of two thousand pounds: —

64.4 pounds of nitrogen	$12 88
169.4 pounds of soluble phosphoric acid	21 18
28.2 pounds of reverted phosphoric acid	2 54
14.8 pounds of insoluble phosphoric acid	89
	$37 49

XVII.

Soluble Nitrogenous Phosphate.

(Manufactured by the Quinnipiac Fertilizer Co., New Haven, Conn.; collected of D. A. Horton, Northampton, Mass.)

	Per cent.
Moisture lost at 100° C.	26.50
Total nitrogen	3.54
Total phosphoric acid	10.69
Phosphoric acid soluble in water	7.36
Reverted phosphoric acid	.47
Insoluble phosphoric acid	2.86
Potassium oxide	1.25
Insoluble matter, sand, &c.	1.60

Valuation per ton of two thousand pounds: —

70.8 pounds of nitrogen	$14 16
147.2 pounds of soluble phosphoric acid	18 40
9.4 pounds of reverted phosphoric acid	85
57.2 pounds of insoluble phosphoric acid	3 43
25 pounds of potassium oxide	1 17
	$38 01

XVIII.

Pine-Island Phosphate.

(Quinnipiac fertilizer Company, New Haven, Conn.; collected of D. A. Horton, Northampton, Mass.)

	Per cent.
Moisture lost at 100° C.	20.00
Total nitrogen	6.14
Total phosphoric acid	7.42
Phosphoric acid soluble in water	2.07
Reverted phosphoric acid	2.46
Insoluble phosphoric acid	2.89
Potassium oxide	2.17

Valuation per ton of two thousand pounds: —

122.8 pounds of nitrogen	$24 56
41.4 pounds of soluble phosphoric acid	5 18
49.2 pounds of reverted phosphoric acid	4 43

	Per cent.
57.8 pounds of insoluble phosphoric acid	3 47
43.4 pounds of potassium oxide	1 97
	$39 61

XIX.

Bradley's XL Superphosphate.

(Messrs. Bagg & Batchelder, Springfield, Mass.)

	Per cent.
Organic and volatile matter	51.77
Ash constituents	48.23
Moisture lost at 100° C.	15.78
Total nitrogen	2.35
Total phosphoric acid	12.15
Phosphoric acid soluble in water	8.06
Reverted phosphoric acid	.60
Insoluble phosphoric acid	3.49
Insoluble matter, sand, &c.	8.25

Valuation per ton of two thousand pounds: —

47 pounds of nitrogen	$9 40
161.2 pounds of soluble phosphoric acid	20 15
12 pounds of reverted phosphoric acid	1 08
69.8 pounds of insoluble phosphoric acid	4 19
	$34 82

XX.

Stockbridge's Manures; Oats.

(Messrs. W. H. Bowker & Co., Boston, Mass.)

	Per cent.
Moisture lost at 100° C.	28.49
Total nitrogen	5.41
Total phosphoric acid	5.25
Phosphoric acid soluble in water	4.64
Reverted phosphoric acid	–
Insoluble phosphoric acid	.61
Potassium oxide	6.24
Insoluble matter, sand, &c.	.32

Valuation per ton of two thousand pounds: —

108.2 pounds of nitrogen	$21 64
92.8 pounds of soluble phosphoric acid	11 60
12.2 pounds of insoluble phosphoric acid	1 10
124.8 pounds of potassium oxide	5 62
	$39 96

XXI.

Stockbridge's Manures; Potato.

(H. C. Comins, Northampton, Mass.)

	Per cent.
Moisture lost at 100° C.	17.49
Total nitrogen	4.42
Total phosphoric acid	4.04
Phosphoric acid soluble in water	3.77
Insoluble phosphoric acid	.27
Potassium oxide	7.59
Insoluble matter, sand, &c.	.64

Valuation per ton of two thousand pounds:—

88.4 pounds of nitrogen	$17 68
75.4 pounds of soluble phosphoric acid	9 43
5.4 pounds of insoluble phosphoric acid	32
151.8 pounds of potassium oxide	11 39
	$38 82

XXII.

William L. Bradley's XL Superphosphate.

(H. Phelps, Northampton, Mass.)

	Per cent.
Organic and volatile matter	59.96
Ash constituents	40.04
Moisture lost at 100° C.	22.82
Total nitrogen	2.99
Total phosphoric acid	12.20
Phosphoric acid soluble in water	8.44
Reverted phosphoric acid	.62
Insoluble phosphoric acid	3.14
Insoluble matter, sand, &c.	2.93

Valuation per ton of two thousand pounds:—

59.8 pounds of nitrogen	$11 96
168.8 pounds of soluble phosphoric acid	21 10
12.4 pounds of reverted phosphoric acid	1 12
62.8 pounds of insoluble phosphoric acid	3 77
	$37 95

Cotton-Dust.

(Sent by Hon. F. W. Bird, Walpole, Mass.)

	Per cent.
Organic and volatile matter	49.07
Ash constituents	50.93
Moisture lost at 100° C.	34.46
Nitrogen in organic matter	.50
Phosphoric acid in ash	.21

	Per cent.
Potassium oxide	.19
Calcium oxide, Magnesium oxide	.9
Ferric oxide	2.15
Sand, &c.	47.46

This material can to some extent be used with advantage in place of barnyard-manure: its fertilizing properties are mainly due to the cotton-seed, which is sparingly found throughout the mass.

Wet Kelp.

(Sent by Mr. John F. Hobbs, North Hampton, N.H.)

	Per cent.
Moisture lost in dry air	87.04
Moisture lost at 100° C.	88.04
Solid residue left at 100° C.	11.96
Ash weight as sulphates	2.26
Nitrogen in wet kelp	.26
Nitrogen in dry kelp at 100° C.	2.14

Ash contains mainly lime, magnesia, phosphoric acid, potassium and sodium oxide, &c. One cord is estimated in its wet state to weigh one ton and a half.

Rockweed (fresh and green).

(Sent by Mr. John F. Hobbs, North Hampton, N.H.)

	Per cent.
Moisture lost in dry air	64.85
Moisture lost at 100° C.	68.50
Ash weight as sulphates	23.70
Nitrogen in fresh and wet state	.615
Nitrogen in dry state at 100° C.	2.05

Ash contains mainly, lime, magnesia, potassium and sodium oxide, phosphoric acid, &c. One cord is estimated to weigh in its wet state two tons.

Dried Rockweed.

(Obtained from Boothbay, Me., and several years old.)

	Per cent.
Organic and volatile	44.25
Ash constituents	55.75
Moisture lost at 100° C.	10.68
Total nitrogen in organic matter	1.45
Potassium oxide	4.89
Sodium oxide	7.90
Magnesium oxide	.21

	Per cent.
Calcium oxide	7.66
Phosphoric acid	2.75
Insoluble matter, sand, &c.	10.40

As the previous analytical statements can aid in an approximate valuation, they may not be without interest to those who are in the habit of using the above-stated materials for fertilizing purposes. The composition of these plants varies on account of the usual presence of shells, and other incidental products of the ocean.

C. A. GOESSMANN,
State Inspector of Commercial Fertilizers.

AMHERST, Feb. 1, 1879.

APPENDIX.

COMPOSITION OF SOME COMPOUNDS IN FERTILIZERS.

One hundred parts of: —

Nitric acid contain 26 parts of nitrogen.

Ammonia contain 82.35 parts of nitrogen.

Pure nitrate of potassa (saltpetre) contain 53.4 parts of nitric acid and 46.6 parts of potassium oxide.

Pure nitrate of soda (Chili saltpetre) contain 63.25 parts of nitric acid.

Chloride of potassium contain 52.4 parts of potassium, 63.1 parts of potassium oxide, and 47.6 parts of chlorine.

Pure sulphate of potassa contain 54.9 parts of potassium oxide and 46 parts of sulphuric acid.

Bone phosphate (tricalcic phosphate) contain 46 parts of phosphoric acid and 54 parts of calcium oxide (lime).

Calcined gypsum contain 41 parts of calcium oxide (lime) and 59 parts of sulphuric acid.

Uncalcined pure gypsum contain 32.5 parts of calcium oxide (lime), 46.5 parts of sulphuric acid, and 21 parts of water.

Carbonate of lime contain 56 parts of calcium oxide (lime) and 44 parts of carbonic acid.

Sulphate of magnesia (free of water) contain 33.3 per cent of magnesium oxide (magnesia) and 66.6 per cent of sulphuric acid.

C. A. G.

The Report was accepted.

Mr. Hadwen, from the committee to nominate four members of the Examining Committee of the Massachusetts Agricultural College in place of those whose terms expire, and of Mr. Ware (resigned), submitted the names of Dr. Nichols to take the place of Mr. Bagg, and Messrs. Moore, Slade, and Bowditch.

The nominations were accepted and confirmed, the committee consisting of Messrs. Nichols, Brown, Moore, Slade, and Bowditch.

Messrs. Phinney, Comins, and Baker were constituted a committee to hear, consider, and report upon any requests for change of time in holding fairs by the societies.

Voted, That the fair of the Barnstable society begin on the fourth Tuesday after the first Monday of September.

A communication having been received from Mr. Harrison of Lowell, requesting the Board to assign his son to the free scholarship held by the gift of the Board in the American Veterinary College of New York, it was

Voted, That the request of Mr. Harrison, together with the whole subject, be referred to a committee of three, with full power to consider and recommend a candidate for the scholarship, — Messrs. Grinnell, Ware, and Comins.

In view of the fact that the exhibitions of cattle at the shows of the different societies receiving the bounty of the State afford about the only means of comparison at any one time of the various breeds, on motion of Mr. Moore it was

Voted, That, in the judgment of this Board, the cattle should be kept on the grounds during the entire exhibition; and that they shall in any event be required to be kept on exhibition until three o'clock in the afternoon of the first day.

Adjourned to ten o'clock on Thursday.

THIRD DAY.

The Board met at ten o'clock A.M., Col. WILDER in the chair.

Present: Messrs. Abbott, Baker, Bowditch, Brown, Comins, Damon, Davenport, Demond, Goessmann, Goodwin, Grinnell, Hadwen, Hersey, Knox, Lewis, Moore, Phinney, Pierson, Slade, Upham, Vincent, Wakefield, Ware, Wheeler, and Wilder.

Mr. GRINNELL, on behalf of the committee appointed to consider and report upon the time and place of holding the public meeting of the Board, reported that the Committee recommend that the meeting be held at Greenfield on the 2d, 3d, and 4th of December.

The Report was accepted.

Voted, To appoint a committee of five, who, with the Secretary, shall be authorized to make the necessary arrangements. — Messrs. Grinnell, Demond, Comins, Smith, and Lewis.

Voted, That the members of the Board be requested to make a personal effort to make a good exhibition in connection with the meeting.

Mr. HERSEY submitted the following report upon the exhibition held in connection with the public meeting at Hingham.

REPORT OF THE COMMITTEE ON THE EXHIBITION AT HINGHAM.

The exhibition of fruit, flowers, vegetables, and seeds, at the meeting of the Board of Agriculture held at Hingham, Dec. 3, 4, and 5, though not as large as it should have been, was quite interesting and instructive; the articles being critically examined by most of those who attended the meeting.

Amos Bates of Hingham exhibited ten varieties of pears.

and six of apples; Charles W. Cushing of Hingham, six varieties of pears, sixteen of apples, three of turnips, four of beets, one of carrots, two of wheat, one of rye, one of barley, and four of grasses, basket of Indian corn, box of onions, box of parsnips, and specimens of pumpkins and squashes; John D. Glazur of Hingham, four varieties of apples, two trusses of Indian corn, box of carrots, box parsnips, specimens of pumpkins, squashes, and watermelons; Edmund Hersey of Hingham, two varieties of apples and a truss of Indian corn; Melzar W. Clark of Hingham, one variety of pears; Nathan Beal of Rockland, truss of Indian corn, one box of oats, one of rye, and one of barley; Alfred Loring of Hingham, box of seedling potatoes; Henry C. Comins, North Hadley, one bottle of sorghum sirup; Edward E. Elms, Cohasset, basket of Indian corn and one box beets; J. N. Bagg, West Springfield, truss of Indian corn, box of egg-turnips; A. L. Murdock of Jamaica Plain, fifty specimens Indian corn, eleven of wheat, three of barley, four of oats, two of rye, six of beet-seeds, one dried beet, amber cane, four specimens of sirup, two of coal and peat, one of redtop-seed, one of rye straw, one of golden and one of pearl millet; Mrs. Starks Whiton of Hingham, a collection of pot-plants.

Among the pears exhibited by Mr. Bates, the Vicar of Winkfield, Beurre d'Anjou, and Beurre Langliere were of large size and in good condition. Of apples the Baldwin, Roxbury Russet, and Northern Spy, were very large and fine.

The seedling potatoes by Mr. Loring, called the Early Perfection, were very fine. This potato originated from a seedling raised by Mrs. Alfred Loring. The flavor is excellent, it keeps well, and the yield is large; but its most valuable qualities, in these days of potatoes, are its rapid growth and early maturity, being from ten days to two weeks ealier than the Early Rose.

The sorghum sirup exhibited by Mr. Comins was made for him at the Agricultural College. The yield was stated to be two hundred and fifty-six gallons per acre. The flavor was excellent.

The specimens of oats, wheat, and barley, exhibited by Mr. Murdock, were very fine, showing what can be accomplished by persevering effort in saving the best seeds.

The specimen of herd's-grass exhibited by Mr. Cushing measured six feet in length; which was remarkable, considering it was cut from a field that has been in grass more than sixty years.

The corn exhibited by Mr. Elms was of very large kernel for eight-rowed yellow corn, being nearly as large as the Webster corn exhibited by Mr. Cushing.

The large number of specimens of corn on exhibition gave the farmers an opportunity to compare them one with another, and draw their own conclusions. That we have much yet to learn in regard to the best way to improve our varieties of corn your Committee have no doubt, and would express the hope that some systematic and united effort may be made by the Board to obtain information on this subject.

The pot-plants exhibited by Mrs. Whiton were very beautiful, and added much to the other attractions of the table.

Respectfully submitted.

EDMUND HERSEY.

The Report was accepted.

Mr. WAKEFIELD, for the Committee appointed to report upon the assignment of delegates, submitted the following: —

Essex	Mr. PIERSON.
Middlesex	Mr. HADWEN.
Middlesex North	Mr. DEMOND.
Middlesex South	Mr. GRINNELL.
Worcester	Mr. WILDER.
Worcester West	Mr. NICHOLS.
Worcester North	Mr. LEWIS.
Worcester North-west	Mr. BROWN.
Worcester South	Mr. DAVENPORT.
Worcester South-east	Mr. KNOX.
Hampshire, Franklin, and Hampden	Mr. SMITH.
Hampshire	Mr. UPHAM.
Highland	Mr. TAFT.
Hampden	Mr. ABBOTT.
Hampden East	Mr. WARNER.
Union	Mr. WHEELER.
Franklin	Mr. BOWDITCH.
Deerfield Valley	Mr. WARE.
Berkshire	Mr. DAMON.
Hoosac Valley	Mr. HERSEY.
Housatonic	Mr. WAKEFIELD.

Hingham	Mr. PIERCE.
Bristol	Mr. VINCENT.
Plymouth	Mr. GOODWIN.
Marshfield	Mr. COMINS.
Barnstable	Mr. BAKER.
Nantucket	Mr. MOORE.
Martha's Vineyard	Mr. PHINNEY.

The Report was accepted, and the assignment made accordingly.

On motion of Mr. Moore it was

Voted, That the agricultural societies receiving the bounty of the Commonwealth be required to arrange and hold not less than three farmers' institutes each year within their limits; and that the Board will render all the assistance in its power to make such institutes instructive and useful to the public; and that the Secretary notify the different societies of this vote.

Professor GOESSMANN then submitted his Fifth Annual Report on

THE IMPROVEMENT OF THE SALT-MARSHES IN THE TOWN OF MARSHFIELD.

The dike has been in excellent condition during the past year, and accomplished its purpose in a satisfactory way. The total expenses for repairs in 1877 did not exceed from seventy to eighty dollars. The entire area of the marshes shows, year after year, more decided signs of a progressing decay within its accumulated vegetable matter, in particular in that portion of it which directly underlies the surface-growth. This desired change, which successive wet seasons in preceding years delayed, has apparently been greatly promoted by the dryness of the late summer. The level of the meadows is gradually sinking, and the entire body of the surface-material becomes, for this reason, more compact. The old tough sod is in many localities already in a very advanced state of decay, and some of the lands have been ploughed during the late autumn with one horse or ox in the furrow.

Although no general well-laid plan of improvements by drainage has as yet, for well-known reasons, been put into operation, the basis on which it ought to rest is duly appreciated by many of the land-owners, and frequently acted upon by individuals as far as their situation permits. Localized impervious layers of soil beneath the surface have been broken through, and the holes filled with coarse stones. Ditches from two to three feet and one-half in depth have been constructed to the nearest branches of the creek: several hundred rods in length of these have been added lately to those of previous years. To dilute the saline subsoil waters, by raising the fresh water of the creek during the spring to the full height of the level of the meadows, and to discharge the mixture resulting subsequently at low tide through the sluice-gate, a measure on a former occasion recommended for that purpose is seriously thought of, and will most likely be tried during the coming spring. Whenever the marshes are left without any attempt at improvement, either fox-grass or upland weeds cover the ground. About four hundred acres, scattered throughout the various sections of the marshes, have been cultivated thus far, in one way or another: a portion of them is, however, still unproductive, comparatively speaking, for want of drainage. Much of the lands but little exposed to a periodical access of stagnant saline subsoil water have yielded fairly when simply sown down with grass-seed without a previous harrowing or ploughing; although in many instances, as might be expected, the seed did not germinate before the second or third year. As the former coarse and tough surface-growth has become more rotten, and the harrow can be used more effectually, the belief that the land can be brought into grass in an economical way, by simply harrowing the old sod, generally prevails.

Ploughing the land has for this reason made but little progress. None, in fact, has been ploughed during the past year, excepting an area of about twenty-five acres, which had been ploughed for the first time three years ago, and subsequently sown down with grain. Yielding, however, indifferently, on account of an unfavorable coarse condition of the turned-up sod, it was left without any further treatment until the late autumn, when it was ploughed again

with excellent success. The surface proved thoroughly rotten, and produced a mellow soil, which will be turned to account, during the coming season, for the production of corn and root-crops. Under the present still somewhat uncertain prospects regarding the future privileges of the owners of the reclaimed marshes, but little can be said against the present practice quite generally adopted of merely harrowing the surface for the production of grasses; being for the time the cheapest mode of cultivation. All parties, however, interested in the enterprise, will do well to remember that the real value of the reclaimed marsh-lands for general farming-purposes cannot be fully known, and thus duly appreciated, until the plough shall have transformed to a considerable depth its various surface-layers (which differ more in regard to the size of the material which constitutes them than in regard to their general chemical character) into a uniform compact soil mass.

The land harrowed and sown to grass the past year yielded a satisfactory crop. Timothy (*Phleum pratense*, L.) and red-top (*Agrostis vulgaris*, L.), either alone or mixed, have given good results. Experiments with grass-mixtures, similar to those advised in a former report, are decided upon: they failed to be carried out during the past year on account of some misunderstanding by the party intrusted with the work. The seeds have been secured by Dr. Henry, a gentleman leading in the improvement of the marshes.

Grass, rye, and oats have been the principal crops raised during the last season. Garden-vegetables did not succeed as well as in previous years on account of the dryness of the summer. Strawberries and onions did, however, remarkably well: the latter received the first premium at the Agricultural Fair. Wherever the grounds were uniformly covered with grass, the crop of hay has amounted to from two to three tons per acre: smaller areas have quite frequently yielded at a larger rate.

N. Ford & Son secured forty tons of hay, N. Holbrook secured fifty tons of hay, S. Henry secured eighty tons of hay, S. P. Ford secured twenty tons of hay, G. M. Baker secured thirty-five tons of hay, estate of T. B. Williams secured fifty tons of hay, M. Goodhue secured thirty tons of hay; and many other parties, in smaller lots: in all four hun-

dred tons or more. About four hundred bushels of rye, in all, have been harvested. The total amount of oats is not known, as part of this crop was cut for green fodder. Hay, rye, oats, and onions were represented at the annual fair of the Marshfield Agricultural and Horticultural Society, and are highly spoken of in the reports of the respective committees: the onions, as stated before, received a first premium. Several applications for premiums on crops raised on the improved marsh-lands sent to the Massachusetts Agricultural Society were not entertained, on the ground that the Marshfield improvement was accomplished before the premium was offered: the premium offered by that society was to apply to future improvements and reclamations of marshes. The prospects of the coming season are, on the whole, quite encouraging, although there is some reason to apprehend, that in some places, where the grass-sod still rests on a spongy substratum, the drought of the latter part of the last summer may have killed in a serious degree the roots of the young grass.

It may be stated that a part of the lands belonging to the estate of the late T. B. Williams of Boston, about two hundred acres in all, which for two years have not been cultivated, have recently been rented for a term of years by parties in Marshfield, who propose to continue the improvements so liberally inaugurated by the late owner. The neglected condition of this property in the midst of success has during the past year greatly marred the general appearance of the marshes. Many people doubted in the outset the general adaptation of the reclaimed sea-marshes for the production of English grass without previous application of top-dressing of some kind or other; yet time has proved otherwise. Those who have seen the grass on these meadows during the past season, or witnessed the carting away of the many loads of good English hay, have had all doubts regarding their productiveness under even moderate chances removed. The results thus far obtained have been more than many of the friends of the enterprise anticipated, and have convinced even the most sceptical, who are open to conviction, of the exceeding natural richness of the soil, and its excellent adaptation for the cultivation of a variety of crops. Still greater results will be secured, no doubt, in

future, providing the improvements are allowed to be developed unchecked by adverse judicial decisions. The lessons taught at Marshfield begin to bear fruit: the successful reclamation, by diking, of seven hundred acres of marsh-lands near Portland, Me., lately reported to us, is a gratifying illustration in that direction.

C. A. Goessmann.

The Report was accepted.

Voted, That the Examining Committee of the Massachusetts Agricultural College, appointed by the Board of Overseers, be requested to investigate certain charges recently made by a committee of the alumni in regard to the management of the College, and to report to the Secretary as early as practicable.

Mr. Grinnell submitted the following lists of subjects, and committees on essays: —

1. "Improvement of Salt-Marshes." Messrs. Goessmann, Baker, and Lane.
2. "Raising and Selecting Field and Garden Seeds." Messrs. Moore, Hadwen, and Warner.
3. "Experiments in Potato-Culture." Messrs. Comins, Knox, and Wheeler.
4. "What has Chemistry done for Agriculture?" Messrs. Nichols, Goessmann, and Abbott.
5. "Cultivation of Small-Fruits." Messrs. Slade, Upham, and Brown.
6. "Basket-Willow and its Culture." Messrs. Hersey, Phinney, and Pierson.
7. "Reclaiming of Swamp-Lands as to Profit and the Public Health." Messrs. Ware, Smith, and Davenport.
8. "Jersey and Guernsey Cattle." Messrs. Hadwen, Bowditch, and Brown.
9. "Poultry-Raising." Messrs. Demond, Lewis, and Damon.

The Report was accepted, and the assignment made accordingly.

On motion of Mr. Hadwen, it was,

Voted, That an executive committee of five be appointed *with full power* to consult and advise with the Committee on Agriculture of the Legislature, and with the Secretary of the Board, in regard to any unfinished or new business that may present itself, — Messrs. Wilder, Hadwen, Ware, Hersey, and Moore.

The Board then adjourned.

The operations of the Board, as will be seen by the foregoing pages, have been continued as usual during the past year. The societies have, for the most part, worked in harmony, and cheerfully complied with the request to hold farmers' institutes, or gatherings of people, to discuss the details of their work, and to consult for their mutual interests; and they have been aided in most cases by the presence and participation of the members of the Board.

It is believed that the influence of the societies will be more direct, and more effective for good, by the frequent association of its members and the enthusiasm that may be awakened by the frequent interchange of thought, than by the mere fact of holding an annual show. With its public exhibitions of stock, its collections of farm-implements, fruits, and farm-products of every description, a society has it in its power to accomplish a good work, and to advance the great interests of agriculture by the diffusion of intelligence among its members and the visitors to its fairs. It brings men together, — men engaged in the same pursuits, and eager to learn the best methods, and to adopt the latest improvements and the best appliances. It illustrates to some extent the advantages of associated effort; but its annual fair imparts instruction chiefly through the eye and by furnishing the means of observation and comparison. It does not appeal so directly nor so forcibly to the mind as the frequent living words spoken at the farmers' institute. However good the influence of a society may already be, it is believed that frequent gatherings for lectures and discussions will extend it to larger numbers of people, and so have the effect to increase the intelligence and elevate the thought of the farming community.

The State Board has always been disposed to aid the societies and the farmers' clubs throughout the State, to the extent of its ability, though it ought to be borne in mind that it has no means at its command to pay for lectures. It has no funds at its control except what the Legislature sees fit to grant for specific purposes. In this respect, as well as in its organization, functions, objects, and methods, it differs wholly from a well-organized society with its treasurer and its accumulation of funds. Nevertheless, its work is more varied and far reaching than many people suppose. The State Board, for example, immediately after its organization, instituted a correspondence and exchange of documents, not only with all the States having state agricultural societies, or similar state boards, in this country, but with many other countries, some of them as distant as the Sandwich Islands and Australia. In this way it has been in the receipt of many documents and books, some of which are of great value: these it has freely placed in public and town libraries, where they are brought within the reach of the people. It has given more than two thousand bound volumes, not including its own reports, to town libraries in the State, within three years.

The methods adopted for the improvement and development of agriculture do not differ materially from those of the older countries of Europe; but the governments of Europe are doing far more to develop, improve, and perfect their agriculture than either our National or State Governments. Not content with innumerable agricultural societies, state and local (by far the larger part of which receive more or less state aid), or with very numerous agricultural colleges and schools devoted exclusively to agricultural science and farm-practice, or with something like eighty scientific experiment stations wholly devoted to investigations in agriculture, they crown the system of state aid by giving the agricultural interest a direct and powerful influence in the central government, and an official dignity which is nowhere recognized in this country. Thus Prussia has its Minister of Agricultural Affairs; France has its Minister of Agriculture, Commerce, and Public Works, and the responsibility committed to this ministry is so great, that its work is subdivided into several bureaus, each having its specific

duties; Belgium, the model of rational and progressive agriculture, has its Department or Board of Agriculture; and so with nearly every country of Europe.

The result is a more complete and perfect system, a wider spread intelligence in rural affairs, and a more powerful influence of science in its relations to the soil, with far greater practical results, than any thing we can show. We shall need to develop a far more liberal and generous spirit towards this great interest, a more realizing sense of the importance of scientific investigations, and a more imperative demand for universal intelligence, before we can claim to have heeded the advice of Washington, or to have done our whole duty in our efforts to develop the possibilities of the production of human food.

CHARLES L. FLINT,
Secretary of the State Board of Agriculture.

BOSTON, January, 1879.

THE FINANCES OF THE SOCIETIES.

FINANCES OF THE SOCIETIES.

SOCIETIES.	Amount received from the Commonwealth.	Income from permanent fund.	New members and donations.	All other sources.	Receipts for the year.	Premiums offered.	Premiums and gratuities paid.	Current expenses for year, not includ'g premiums and gratuities.	Disbursements for the year.	Indebtedness.	Value of real estate.	Value of personal property.	Permanent fund.
Massachusetts . .	–	$5,853 26	–	$5,853 26	–	–	–	$395 72	$6,461 38	–	–	$77,932 47	$77,932 47
Essex	$600 00	1,553 96	$136 00	2,452 92	$4,742 88	$3,224 00	$1,627 00	2,513 54	4,140 54	–	$6,000 00	15,000 00	21,000 00
Middlesex . . .	600 00	–	116 00	2,387 85	3,103 85	1,954 50	1,132 65	1,228 72	3,624 27	$17,320 00	25,000 00	200 00	7,000 00
Middlesex North .	600 00	250 00	63 00	1,645 57	2,558 57	1,334 00	677 25	1,958 69	2,635 94	1,500 00	20,000 00	2,500 00	20,000 00
Middlesex South .	600 00	–	5 00	2,293 80	2,798 80	1,284 75	628 55	1,831 87	2,736 77	11,000 00	–	18,000 00	7,000 00
Worcester West . .	600 00	–	59 00	2,249 32	2,908 32	1,870 25	1,576 68	1,099 34	2,859 15	3,350 00	12,500 00	700 00	9,850 00
Worcester North .	600 00	–	569 10	2,777 09	3,346 25	1,107 60	1,107 60	1,744 18	2,940 28	11,600 00	16,000 00	584 63	4,984 63
Worcester No.-west,	600 00	–	92 50	2,499 20	3,191 70	1,721 00	1,269 59	1,549 71	3,319 30	7,672 47	12,500 00	750 00	5,577 53
Worcester South .	600 00	1,000 00	62 00	2,529 38	3,291 38	1,545 00	1,235 80	1,031 15	3,373 15	2,070 00	12,000 00	1,400 00	11,330 00
Worcester So.-east .	600 00	–	108 00	2,778 65	3,486 65	1,490 00	890 22	2,481 29	3,371 51	10,239 30	10,000 00	1,000 00	760 70
Hampshire, Franklin, and Hampden	600 00	–	66 00	2,169 02	2,835 02	986 72	598 28	1,774 80	2,831 39	8,762 10	3,500 00	–	–
Hampshire . .	600 00	–	118 79	633 24	1,352 03	725 00	602 55	470 19	1,262 74	–	3,000 00	150 00	3,000 00
Highland . . .	600 00	42 00	26 00	525 25	1,193 25	783 80	601 50	439 25	1,040 75	–	3,000 00	700 00	3,700 00
Hampden . . .	541 57	–	15 00	512 29	1,068 86	1,465 10	459 26	625 15	1,084 41	26,109 00	35,000 00	–	8,891 00
Hampden East . .	600 00	–	122 51	823 17	1,545 68	1,183 75	851 60	685 92	1,537 02	137 44	5,000 00	–	5,000 00
Union . . .	600 00	–	103 00	1,416 67	2,119 67	1,119 50	727 32	1,391 83	2,119 15	26 75	5,000 00	997 13	5,970 90
Franklin . . .	600 00	120 00	90 00	1,529 82	2,339 82	930 25	671 00	1,501 35	2,308 49	2,000 00	9,000 00	1,650 00	10,000 00
Deerfield Valley .	600 00	–	192 62	1,056 43	1,849 05	800 00	689 41	1,159 64	1,849 05	2,107 09	8,070 00	100 00	6,062 91
Berkshire . . .	600 00	525 00	144 00	3,355 07	4,624 07	2,500 00	2,270 50	1,744 81	4,015 31	1,400 00	6,000 00	1,200 00	5,800 00
Hoosac Valley[1] .	–	–	–	–	–	–	–	–	–	–	–	–	–

Housatonic	600 00	-	104 00	4,258 49	4,962 49	3,133 50	2,863 00	2,419 62	4,841 33	-	8,000 00	1,000 00	9,000 00
Hingham	600 00	-	226 87	1,827 37	2,654 24	1,234 00	666 00	1,830 25	3,040 90	4,000 00	34,600 00	4,600 00	35,200 00
Bristol	600 00	-	118 00	8,119 90	8,852 90	3,405 50	3,887 77	3,708 44	9,044 56	11,500 00	50,000 00	300 00	37,500 00
Plymouth	600 00	337 00	235 00	6,155 89	7,327 89	2,947 00	2,600 24	2,582 63	6,933 30	11,526 00	40,000 00	2,000 00	30,474 00
Marshfield	600 00	-	60 00	2,276 29	2,936 29	1,042 00	569 70	2,366 59	2,936 29	4,300 00	11,856 92	1,372 98	8,929 90
Barnstable	600 00	16 23	53 50	1,020 39	1,690 12	1,102 00	705 90	704 32	1,660 22	750 00	6,000 00	200 00	5,450 00
Nantucket	600 00	34 00	49 00	422 63	1,105 63	1,149 00	611 20	466 93	1,078 19	-	2,800 00	285 56	3,085 56
Martha's Vineyard	600 00	139 31	20 50	470 50	1,230 31	868 50	743 70	480 60	1,324 30	200 00	2,000 00	2,000 00	4,000 00
Totals	$15,541 57	$9,970 76	$2,903 39	$65,039 46	$79,115 72	$40,896 72	$30,464 27	$40,186 53	$84,369 69	$137,260 15	$346,326 92	$144,622 77	$347,499 60

[1] Returns not received.

PERMANENT FUND, — HOW INVESTED.

MASSACHUSETTS. — In bank-stock, railroad stock and bonds, mortgages and mortgaged bonds, policies in Massachusetts Hospital Life-Insurance Company, and cash.

ESSEX. — In bank-stock, railroad-bonds, farm, cattle-pens, library, &c.

MIDDLESEX. — In land and buildings.

MIDDLESEX SOUTH. — In grounds, buildings, sheds, stalls, pens, track, &c.

MIDDLESEX NORTH. — In land and buildings.

WORCESTER WEST. — In real estate and personal property.

WORCESTER NORTH. — In real estate and hall.

WORCESTER NORTH-WEST. — In grounds and building, including track and fences, and in personal property.

WORCESTER SOUTH. — In land, track, hall, furniture, and fixtures.

WORCESTER SOUTH-EAST. — In real estate and personal property.

HAMPSHIRE, FRANKLIN, AND HAMPDEN. — In real estate and personal property.

HAMPSHIRE. — In real estate.

HIGHLAND. — In real estate and mortgage notes.

HAMPDEN. — In real estate.

HAMPDEN EAST. — In fair grounds, buildings, &c.

UNION. — In park, hall, furniture in hall, and barn.

FRANKLIN. — In park, buildings, bank-stock, office-furniture, &c.

DEERFIELD VALLEY. — In real estate.

BERKSHIRE. — In real estate.

HOUSATONIC. — In real estate and notes.

HINGHAM. — In real estate and exhibition buildings.

BRISTOL. — In real estate.

PLYMOUTH. — In real estate, furniture, and fixtures.

MARSHFIELD. — In land, buildings, and hall-furniture.

BARNSTABLE. — In land and buildings.

NANTUCKET. — In grounds and buildings, hall fixtures and furniture, and cash.

MARTHA'S VINEYARD. — In hall and fair grounds, and notes of members.

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED.

SOCIETIES.	Total am't offered for management and improvement of farms, orchards, &c.	Total amount paid for management and improvement of farms, orchards, &c.	For neat and dairy stock.	For horses.	For all other farm-stock.	Total amount offered for live-stock.	Total amount paid out for live-stock.	For cereals and seed.	For roots and vegetables.	Total amount offered for grain and root crops.	Total amount paid out for grain and root crops.	For fruits, flowers, &c.	For dairy-products.	For bread, honey, and preserved fruits, &c.	Total amount paid out under the head of farm-products.
Massachusetts .	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Essex . . .	$350 00	$172 00	$415 00	$263 00	$130 00	$1,165 00	$785 00	$44 00	$160 00	$240 00	$66 00	$270 50	$41 00	$14 00	$885 00
Middlesex . .	113 00	-	150 00	132 00	153 00	716 50	435 00	9 00	104 00	158 00	44 00	239 50	12 00	51 00	394 50
Middlesex North,	55 00	33 00	200 00	166 00	104 00	775 00	310 00	15 00	59 50	141 00	89 00	183 50	16 00	57 00	255 00
Middlesex South,	108 75	49 75	174 00	95 00	152 00	488 00	309 00	19 00	58 00	137 00	74 25	75 35	9 75	42 50	202 10
Worcester West,	187 00	90 00	405 00	214 00	96 00	822 00	672 75	-	4 00	82 00	14 50	86 05	44 00	12 00	169 30
Worcester North,	16 00	-	132 50	91 00	115 75	362 00	339 25	22 75	12 50	58 25	35 25	93 25	27 50	11 00	228 50
Worcester N.-W.,	24 00	24 00	362 00	116 00	91 50	729 00	540 29	19 00	15 00	50 00	39 66	40 50	20 00	8 00	102 30
Worcester South,	135 00	-	226 00	75 00	143 00	533 00	444 00	33 00	10 25	54 00	51 00	54 75	27 00	22 00	152 55
Worcester S.-E.,	244 00	115 00	322 00	153 00	92 50	884 50	683 12	7 00	54 50	166 00	42 75	59 00	19 00	12 25	124 00
Hampshire, Franklin, and Hampden,	20 00	-	210 50	128 50	165 75	578 00	459 25	3 50	18 75	77 00	23 50	63 25	13 00	11 50	101 63
Hampshire . .	-	-	99 00	98 00	123 00	409 00	222 30	7 50	18 00	47 00	40 00	69 50	13 00	20 50	186 50
Highland . .	56 00	59 00	159 75	119 00	100 75	502 75	379 50	-	7 75	15 00	7 75	20 00	11 50	2 65	41 90
Hampden . .	221 00	12 50	183 00	117 00	69 50	773 00	319 00	9 50	32 00	116 00	13 50	73 50	6 00	9 00	14 26

Hampden East .	184 00	33 00	216 00	105 00	103 00	498 00	424 00	17 00	14 50	90 00	32 00	53 25	23 00	14 75	44 50
Union . . .	22 00	16 50	205 00	90 00	120 75	810 50	551 62	27 60	36 90	61 80	50 80	18 10	16 50	10 50	75 20
Franklin . .	48 00	-	192 00	97 00	147 00	498 00	422 25	4 00	36 00	66 00	17 00	93 50	20 00	23 25	170 75
Deerfield Valley,	31 00	4 75	187 00	115 00	179 25	500 00	481 25	11 10	8 75	90 00	21 85	37 75	9 25	21 50	90 35
Berkshire . .	113 00	101 00	342 00	187 00	280 75	927 00	809 75	179 00	156 00	339 00	335 00	91 00	32 00	30 00	488 00
Housatonic . .	277 00	249 00	346 00	208 00	392 00	946 00	1,085 00	415 00	101 00	520 00	516 00	146 00	71 00	82 00	816 00
Hingham . .	134 00	18 00	181 00	58 00	123 50	658 00	362 50	-	44 70	102 50	34 95	91 30	13 00	17 94	166 94
Bristol . .	262 00	20 00	586 00	212 00	309 00	1,541 25	1,107 00	89 00	5 00	193 00	100 00	176 50	51 00	27 25	131 00
Plymouth . .	225 00	69 00	476 00	178 00	210 76	983 00	864 76	166 00	61 75	327 50	207 75	165 25	58 00	36 00	487 00
Marshfield . .	73 00	37 00	130 00	56 50	62 00	307 50	248 50	-	48 00	97 00	-	88 85	18 00	23 55	178 40
Barnstable . .	97 00	27 50	146 00	55 00	100 00	333 00	301 00	10 00	43 50	197 00	53 50	76 25	12 00	30 00	171 75
Nantucket . .	111 00	38 00	135 00	41 50	85 50	596 00	262 00	17 00	21 75	149 00	17 00	61 25	8 00	12 50	154 50
Martha's Viney'd,	65 00	22 00	212 65	58 50	79 75	401 25	350 90	55 00	60 80	144 00	76 00	56 52	19 00	49 00	200 52
Totals . .	$3,171 75	$1,191 00	$6,423 40	$3,229 00	$3,630 01	$17,937 25	$13,168 29	$1,179 95	$1,242 90	$3,718 05	$1,993 01	$2,484 17	$610 50	$651 64	$6,032 45

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED. — *Concluded.*

MISCELLANEOUS.

SOCIETIES.	For agricultural implements.	Offered for raising forest-trees.	For experiments on manures.	Amount awarded for objects strictly agricultural not already specified.	Amount awarded and paid out for trotting horses.	For objects not strictly agricultural: domestic manufactures, &c.	Number of persons who received premiums and gratuities.
Massachusetts	-	-	-	$562 26	-	$5,503 40	-
Essex	$50 00	-	-	-	-	167 00	560
Middlesex	40 00	$50 00	-	3 00	$475 00	124 75	220
Middlesex North	12 00	-	-	-	-	33 00	172
Middlesex South	2 25	60 00	-	-	253 10	102 00	127
Worcester West	11 00	30 00	$10 00	-	591 00	50 00	220
Worcester North	-	25 00	-	-	315 00	252 85	393
Worcester North-west,	5 00	30 00	-	-	555 00	60 95	176
Worcester South	-	35 00	-	-	477 00	51 75	183
Worcester South-east	7 00	30 00	-	-	475 00	818 80	393
Hampshire, Franklin, and Hampden	6 00	20 00	-	-	350 00	76 75	164
Hampshire	15 00	16 00	-	-	190 00	113 75	212
Highland	4 00	-	-	-	-	117 10	247
Hampden	30 00	30 00	15 00	26 50	-	15 25	91
Hampden East	16 00	25 00	86 00	-	195 00	50 85	167
Union	1 75	-	-	-	86 00	19 25	218
Franklin	-	10 00	5 00	-	-	98 50	300
Deerfield Valley	5 00	-	-	-	-	86 21	421
Berkshire	56 00	-	-	-	500 00	315 75	556
Housatonic	-	-	-	-	490 00	364 00	751
Hingham	-	50 00	-	9 00	-	108 55	268
Bristol	41 00	23 00	60 00	22 00	1,723 35	383 55	710
Plymouth	29 00	60 00	-	18 00	790 00	340 48	518
Marshfield	13 25	50 00	-	-	130 00	137 15	580
Barnstable	-	7 00	12 00	-	80 00	125 65	299
Nantucket	-	13 00	19 00	-	30 00	125 70	203
Martha's Vineyard	-	11 00	-	-	10 00	160 28	300
Totals	$344 25	$575 00	$207 00	$640 76	$7,725 45	$10,303 27	8,449

THE FARM HOMESTEAD.

ABSTRACT OF RETURNS

OF THE

AGRICULTURAL SOCIETIES

OF

MASSACHUSETTS.

1878.

EDITED BY

CHARLES L. FLINT,

SECRETARY OF THE STATE BOARD OF AGRICULTURE.

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AGRICULTURAL EXHIBITIONS, 1879.

ESSEX, at Lynn, Sept. 16 and 17.
MIDDLESEX, at *Concord*, Sept. 25, 26, and 27.
MIDDLESEX NORTH, at *Lowell*, Sept. 23 and 24.
MIDDLESEX SOUTH, at *Framingham*, Sept. 16 and 17.
WORCESTER, at *Worcester*, Sept. 2, 3, 4, and 5.
WORCESTER WEST, at *Barre*, Sept. 25 and 26.
WORCESTER NORTH, at *Fitchburg*, Sept. 23 and 24.
WORCESTER NORTH-WEST, at *Athol*, Sept. 30 and Oct. 1.
WORCESTER SOUTH, at *Sturbridge*, Sept. 11 and 12.
WORCESTER SOUTH-EAST, at *Milford*, Sept 23, 24, and 25.
HAMPSHIRE, FRANKLIN, and HAMPDEN, at *Northampton*, Oct. 1, 2, and 3.
HAMPSHIRE, at *Amherst*, Sept. 18 and 19.
HIGHLAND, at *Middlefield*, Sept. 11 and 12.
HAMPDEN, at *Springfield*, Sept. 23 and 24.
HAMPDEN EAST, at *Palmer*, Sept. 16 and 17.
UNION, at *Blandford*, Sept. 17, 18, and 19.
FRANKLIN, at *Greenfield*, Sept. 25 and 26.
DEERFIELD VALLEY, at *Charlemont*, Sept. 18 and 19.
BERKSHIRE, at *Pittsfield*, Sept. 30, and Oct. 1 and 2.
HOUSATONIC, at *Great Barrington*, Sept. 24, 25, and 26.
HOOSAC VALLEY, at *North Adams*, Sept. 16 and 17.
BRISTOL, at *Taunton*, Sept. 23, 24, and 25.
PLYMOUTH, at *Bridgewater*, Sept. 17, 18,and 19.
HINGHAM, at *Hingham*, Sept. 23 and 24.
MARSHFIELD, at *Marshfield*, Sept. 10, 11, and 12.
BARNSTABLE, at *Barnstable*, Sept. 23 and 24.
NANTUCKET, at *Nantucket*, Sept. 3 and 4.
MARTHA'S VINEYARD, at *West Tisbury*, Sept. 30 and Oct. 1.

AGRICULTURE OF MASSACHUSETTS.

SUGGESTIVE FARM-HINTS.

[From an Address before the Essex Society.]

BY T. C. THURLOW.

I HAVE chosen for my subject "Suggestive Hints;" and it will, perhaps, be excusable, if I indulge in a few friendly criticisms on the general management of farms in this vicinity at the present time.

In the first place, every farmer, if he has not already done so, should sit down carefully and candidly to consider to what crop or crops his farm is best adapted in relation to its nearness to or distance from a market; the quality of the soil, — whether heavy or light, whether best adapted to grass, and the raising of stock and the production of milk, or the growing of early vegetables and small-fruits. He might with profit consult his more experienced neighbors in regard to it, and, after being fully persuaded what course to pursue, let him stick to it. Not changing from one crop or system to another, but making a specialty of some particular branch of husbandry, he will in the long-run succeed in any, provided he combine with it a sufficient amount of skill, prudence, and industry. Perhaps there is no one thing in which farmers as a class are so deficient as in a regular system of keeping accounts, in knowing in dollars and cents what this or that crop costs, or what is the actual profit from each animal. In what other business could a man succeed who was so generally negligent of his accounts? These can be kept every day in the most simple manner; so that, at the end of the year, he can easily see what it has cost the family for sugar, for butter, for milk, and for flour. The cost and proceeds of

every animal and crop can also be very nearly estimated. The result would be, that the yearly income from one cow would be found to be thirty or forty dollars, that of another seventy-five to a hundred; one yoke of oxen would have depreciated in value twenty-five or thirty dollars, while another would have gained as much; it would be seen that two old broken-down horses would be less serviceable than one good one well kept; and so on.

A short time since, in talking with a smart, active New-Hampshire farmer, he said to me, "I can raise corn at thirty cents per bushel." Being asked if he reckoned the loss to his land, interest, taxes, &c., he replied, "No: if you reckon all these, there is no profit in any crop." But they should all be taken into the account; then, if it is found there is no real profit, it shows the need of still closer observation and care.

Recently, at a very pleasant dinner-party given by a gentleman of this county, supposing he had owned his farm but a few years, I asked him how long he had lived upon his estate. His reply was, "Two hundred and fifty years." This he immediately qualified by saying, "Perhaps one hundred and fifty years, or ever since the settlement of the country." Friends, many of you have lived upon your farms a hundred and fifty years; and as you look back, and see the work that your fathers have accomplished, will you rest satisfied with your present attainments? The world moves forward in science, in art, in agriculture; and those of you who will occupy these farms a hundred and fifty years hence, will, or ought to be, as much in advance of us of the present day as we are ahead of our fathers of a hundred and fifty years ago.

Make improvements; commence at home. Is there nothing about your house which can at a trifling expense be made more attractive and beautiful? — a new coating of paint, the old chimneys modernized and repaired, a bay-window here to contain the flowers, or a portico there both for comfort and ornament. Have your family all the conveniences they require and deserve? Are the best modern improvements in kitchen, pantry, and living-room? Is a good supply of dry fuel always on hand in a convenient place? Is pure healthful water accessible at all times to the house and stable? Have you carefully examined the drainage about your

premises to see that no subtle under-current is gradually destroying the health of yourself and family?

While this subject has received so much attention from sanitary committees and physicians in our larger cities, I think it has been very much neglected in our country homes. Have you good ventilation in every apartment of your house? If not, secure it as soon as possible. Make home pleasant for the children: while they have their books, their papers, and their games for winter, they should also have their croquet-ground, their pet animals, and their flower-garden. Who of us that are older does not remember with pleasure the old cherry, pear, or early apple tree in our father's garden? What boy who has ever owned a pet colt, or a pair of steers, and called them his, if he lives to be a man, and becomes a farmer, will not love his profession better, and be a better farmer, for having owned them?

Many a boy has been driven from his paternal home, who would otherwise have staid, and adopted the profession of his father, had not that father, with too close a grasp and too arbitrary a disposition, treated him merely as a hireling, not consulting with him in his plans and purposes, and finally threatening to disinherit him if he should leave his home, and not become a farmer. You fathers who have children grown up to years of discretion, why not lot out your property to them, or at least have it understood what part, in case of your death, each one is to have, — whether of land or money, — that they make improvements upon and take an interest in what is to be theirs, and not feel that only at death will it be released from your tight grasp, and look forward to that event with pleasure rather than with sorrow?

Next to the house, the barn should receive special attention. It should be convenient and airy, at the same time tight and comfortable for the domestic animals. There should always be a cellar under it, if practicable. Plenty of dry muck and loam should be on hand to mix with the manure, and absorb the ammonia. Every thing about the premises should be kept sweet and clean. The wash from the house and sink-drain should all be utilized and saved; mixed with dry earth, it contains very much of fertilizing material. Good water at all seasons of the year is indispen-

sable in the barn-yard. Many a farm in this county, at a trifling outlay of a hundred or a hundred and fifty dollars, could be supplied with pure running water the year round; while now a great amount of hard labor is expended in drawing or pumping water for the cattle, and by the inmates of the house, in going, perhaps, rods through winter's snow and summer's sun to bring water for household purposes.

A large amount of money is every year wasted by the neglect of tools. Carts and farm-wagons are often left unpainted and uncared for till they fall to pieces through sheer neglect. A plough, cultivator, mowing-machine, or steel-tooth horse-rake, is often more injured by being exposed in one rain-storm, or even in several heavy dews, than by years of use. Get the best, and take good care of them, and buy no more than are absolutely needed, should be the motto of every farmer. The farmer should plan out his work for weeks and months ahead. There are in every season certain days that are most suitable for planting, for haying, and for harvesting: these, if neglected, often result in serious loss. It was the maxim of a successful farmer, always to have work under cover for rainy days, and never to work in-doors in pleasant weather.

No farmer who cares for the health and comfort of his family will be without a good vegetable-garden, the real value and luxury of which cannot well be reckoned in dollars and cents.

A neat and well-kept flower-garden is always a source of pleasure and refinement, and it is surprising to notice the improvement in floriculture within a very few years. Nearly every door-yard contains asters, verbenas, and geraniums, for which, ten years ago, any florist in the country would have taken first prizes.

The farmer should *think* as well as work. His library, however small, should contain a few of the best standard works and the leading agricultural papers: none of them but will suggest some idea, and the thought goes before the act.

A farmer's club is of great value always, both for its practical utility and for drawing out the best social qualities. The rural town where I live has sustained such a one uninterruptedly for over twenty years; and, although many of the

earlier members have left us, their words, their thoughts, still live in our community.

Shade-trees, which are indispensable in their proper place, are often planted too thickly, and too near our dwellings, especially in towns and villages, thus causing them to be dark and unhealthy when they should be light and cheerful. The larger species of evergreens are very much out of place on the sunny sides of our houses; while they would be very appropriate and necessary as screens and wind-breaks along the cold and exposed sides of our buildings. I would recommend that a permanent committee on planting and locating shade-trees be chosen in every town and village: the office would seem almost as important as that of the architect or landscape-gardener. Rows of deciduous trees planted along our roadsides would add much to the beauty and fertility of our farms; and a proper alternation of the maple, ash, beech, and chestnut, would produce a very pleasing and beneficial effect.

If the roads, especially near our houses, were kept clean of bushes, and instead of unsightly holes, piles of stones and other rubbish, the rough places were made smooth, and sown down to grass, then might our roadsides present the appearance of beautiful lawns, and at the same time be made profitable from the crops of grass which could every year be taken from them. Formerly hogs were allowed to run at large in the public roads; but modern civilization has confined these animals to proper limits: it is to be hoped, that, at no distant day, cattle and horses will be thus restrained, and not allowed to trespass where they have no more legal right than in your neighbor's fields and garden.

Many of the apple-orchards of this county have of late years been sadly neglected. Perhaps the trees were formerly planted too thickly, and there were too many of them; but if they had received proper care, and been protected from insects, they would to-day have been a source of great profit. Thirty years ago, according to a careful record kept at that time by my neighbor Major Poore, there were fourteen thousand barrels of apples raised in the town of West Newbury in a single year — very largely of Roxbury Russets. Now there are probably not over five thousand barrels raised in the same town in a productive year. Good winter apples, like the Baldwin and Russet, will always sell at fair prices.

Foreign markets are just being opened for them; and we near the seacoast have the advantage for shipping of those living inland. Let us learn to pick and sort our apples with more care, and put them up *honestly* in clean nice barrels, then our fruit will soon have a reputation abroad, and will be always sought for at good remunerative prices.

There are other fruits which might be raised to advantage in this county, and with experience, and a fair amount of skill, could be made as profitable as any other farm-crop.

Pears, peaches, quinces, and plums are adapted to this section, and can be grown here to perfection. Grapes, which ripen tardily in our New-England climate, are desirable for family use: some of the earliest varieties should be cultivated, and may possibly be raised with profit for the market. Cherries are a luxury; but they add much to the pleasures of home, and no fruit-garden is complete without them. Strawberries and the other small fruits are a fixed fact; no town or village in the future but will have them: even at the present low prices, they are a paying crop. While people in cities, even of moderate means, have learned to use fruit freely as a necessary article of food, it is to be feared, that, in the country, the fruit-garden has been too often neglected. This is next in importance to the vegetable-garden; and no farmer should fail to furnish his family with a supply of fruit, from the earliest strawberries to the latest winter apples and pears.

It is to be regretted that many varieties of fruit which were formerly raised here in great abundance should have been almost wholly abandoned. For instance, winter pears, very delicious for cooking, were found on many farms almost as plenty as apples; now the trees are cut away and destroyed: instead, we see long-named exotics, which never can or will fill the places of our former favorites. The same will apply to plums and some other fruits. While it may be said that the varieties have deteriorated, or the soil become exhausted, or that insects have increased more than formerly, it may be replied that what is worth little costs us little; what is worth having is worth working for; that he who becomes discouraged or faint-hearted because of drought, mildew, or a few insects, is not deserving of the fruits which a bountiful Providence would bestow upon us.

There is scarcely a farm in this county but what contains some piece which would well pay for under-draining,—some unsightly hollow, some damp meadow, usually the best and most productive land on the farm if properly under-drained. Have you who raise strawberries for the market ever tried such a piece? Did not the crop surprise you who have under-drained for grass? Two-inch tile from a neighboring town can now be delivered at any depot in this county at twenty dollars per thousand feet. These should be laid at a depth of not less than three feet and a half, with a fall of at least one inch to the rod. With the low price of labor at the present time, the cost is not as much as one would at first suppose.

Probably there is no better stock for the farmer in general in this vicinity than milch cows. In order to maintain the fertility of our soil, we should keep as many as possible, get the best, and feed well. But what to do with the milk is the problem. A few years ago, when there appeared to be an unlimited demand, the prospect was good; it is so now to a certain extent: still many of us have been obliged, the past summer, to sell our milk at less than the cost of production. The demand for good butter is unlimited; and my own opinion is, that butter-making under the Harden system (that is, setting the milk in deep cans at a low temperature) would be better for many of us than selling milk at the present prices.

Some of our farmers refuse from year to year to bring up their best stock to this exhibition, saying they have very little chance with the petted animals of the few who generally take the premiums. This difficulty may be all imaginary; but is there not some danger that even this old society, which has always so nobly excluded the race-course, shall, through her committees, refuse a premium to a colt which would otherwise be a valuable family or draught horse, because its ancestors could not show a record of less than three minutes? The impression, too, seems to have gone abroad, that, under the rules of this society, none but members will be allowed to take premiums. This is erroneous, as the prizes are open to all residents of the county who will conform to the printed rules and regulations.

A great improvement has been made of late in cutting

grass earlier than formerly: it is now generally admitted by our most practical farmers, that all kinds of grasses should be cut when they are in flower, or very soon afterwards. We have along our sea-coast several thousand acres of land, known as salt-marshes, which might be made more valuable by judicious ditching and diking. The grasses on these meadows are very apt to be neglected till late in the season, one or two months after they have blossomed and gone to seed; then the hay is comparatively worthless. The most valuable of these, the black-grass (*Juncus gerardi*), was in blossom this year June 20, and the fox-grass (*Spartina juncea*), July 20. Bordering on the Parker River in Newbury are about two thousand acres of these marsh-lands which by a dam near the mouth of the river, at the estimated cost of thirty thousand dollars, might be rendered very valuable for growing any of the upland crops.

Those who have travelled through this county for the past few years must have noticed the very poor condition of many of the roads, especially in the vicinity of Lawrence, and in the interior. The roads in several of the towns in the south-eastern section of the county are excellent, and those who have the care of them deserve much praise. Would it not be well for towns, in choosing surveyors, to select men who know the difference between gravel suitable for roads, and soil adapted to the compost-heap?

On some of our farms the fences are in bad condition. Many a man spends more time in driving the cattle from the mowing-lot and cornfield in haytime than he would in making good fences at the proper season. If we would keep our cattle and sheep from being unruly in summer, we must have good fences to start with in the spring.

The farmer should be *temperate* in every thing, — in eating and drinking, in sleeping and working; not doing two days' work in one, or overworking his tired body, because he sees so much to do. It is to be hoped that the day will soon come when the use of rum, or even cider, in the harvest-field, or on any other occasion, will be entirely among the things that were; and if those who possess wealth and culture would set an example in this respect, and abolish from their tables and entertainments all wines and other liquors, and join heart and hand in the good work, how soon might this

demon of intemperance be entirely abolished from our state and nation!

The question may arise, How can a young man without capital or experience get his farm? I reply, Work for others. Working steadily, honestly, and perseveringly, he will soon have the trade, and, if he is prudent, will save as much money, on the average, at this as at any other business. Let him begin with a small farm in a careful way, not expecting too large profits; perhaps by leasing one for a term of years he can acquire the requisite skill and capital. He should plan eventually to own his farm; for a man is twice the man every way who owns the land he works upon. A man of my acquaintance who had lived upon a farm for several years, and afterwards bought it, said, after he owned his place the very stones of which he built his fences seemed lighter than before.

A farmer to succeed should be in earnest, should be *enthusiastic* in his work. In what other business can one excel without enthusiasm? But you may reply, "These are hard times; milk is down to the lowest figure; butter, cheese, pork, and beef command only the lowest prices: what is left after the potato-bug, the canker-worm, the cabbage-fly, and the onion-worm, is hardly worth marketing." My friends, if half the time which is spent in grumbling were devoted to earnest, cheerful work, times would have been better than they are, before this. Perhaps this may be true of other professions than farming.

A friend and neighbor of mine, having recently failed in the mercantile business, went immediately back to his former occupation, took charge of a small schooner, and, as it were, began life anew. Being asked if he could make any thing, he replied, "Perhaps not; but I shall be all ready and in business when the good times do come." So with us farmers: we cannot *afford* to let our farms go to waste, to let our trees die of neglect and be eaten up by insects. We should be *up* and doing: the "good times" will come before we are aware of it. More than half of the farmers in this county with whom I have any acquaintance have money in the savings bank. Which is the best investment, — money in the Five Cents Savings Banks, and railroad shares, or in beautifying and making comfortable our own homes, in under-drain-

ing land, buying manure, repairing fences, and in a thousand ways adding to the value and convenience of our farms, at the same time aiding the unemployed who stand waiting and asking for our assistance?

But it is not all dollars and cents that we live or should live for: culture and refinement are equally to be sought after. It is a law of our being, that, after the immediate wants of the body are supplied, we turn to the study and enjoyment of the beautiful, both in nature and art. The man who leaves his New-England home among the hills for the Western prairie goes for gain — a very commendable object, certainly, if it is not carried too far; but as soon as he has made himself a comfortable home, and provided for the wants of his domestic animals, he naturally thinks to beautify his surroundings, planting a group of trees here, or a line of evergreens there, not forgetting the vines, shrubs, and flowers, which will do so much to make his home cheerful, and his family happy. In older countries this is carried still further, till the parks and gardens of England, France, and Germany, are known world-wide, and are held out as examples to us on this side of the Atlantic, oftentimes not so much to our help as discouragement.

Our two largest cities, New York and Philadelphia, have expended immense sums in laying out public parks, and in both instances have copied and imitated nature as far as possible. Beautiful lawns, wooded glens, and primeval trees, are preserved in their natural beauty; and the highest style of landscape-gardening takes nature for its teacher.

Many of the farmers of this county look out of their own windows upon lawns as fair and sloping as can be found in Fairmount or Central Parks. Their estates contain grottos and glens as lovely and secluded as in either of these, and forest or woodland as varied as that of any public park in the country, and more extensive.

I know of no way of enjoying these scenes in nature so profitably as by doing as we have in West Newbury (you will excuse me for referring again to my own town by way of illustration). We have a little botanical club, some three years of age, which, having struggled hard for an existence in its earlier days, now numbers over forty-five members, including many of our most intelligent and valuable

citizens. Our two physicians were unwittingly drawn in, not suspecting that the thing was interfering with their means of a livelihood; and we hope at an early day to dispense with the services of both these gentlemen, although we value them highly as friends and townsmen. Our plan is to hold field-meetings about once a month, especially during spring and autumn. A pleasant grove in some neighboring town is generally selected as a place of rendezvous, to which the members go by different routes, at their own convenience. A basket picnic at noon is usually followed by a discussion, in the most friendly and familiar way, of the various specimens we have gathered; and all return home at an early hour, pleased and delighted with the occasion; and we are unanimously agreed that our minds and bodies are so refreshed and invigorated by these little respites, that we can perform more labor, both mental and physical, than if we had not indulged in them. We meet once a month during winter, at the house of some member, to hear an essay, and enjoy a social chat on any subject connected with botany. But the principal enjoyment comes from our rambles in summer through woodland and pasture in search of wild flowers, which is delightful in itself, besides being eminently healthful. We believe thoroughly in out-of-door exercise for all classes, and that walking, suitably dressed, with a pleasant object in view, is far better for health than riding in fashionable luxurious carriages. We have known several invalid ladies who have entirely recovered their health by this same sort of exercise.

Are there any young ladies here who are losing the color from their cheek, or the elasticity of their step; whose parents are contemplating a trip to Florida to avoid our New-England winter, or have sought the mountains in summer? Did you ever try the medicine of walking? Do you know where in all your vicinity to find the earliest arbutus, hepatica, or bloodroot? Do you know in what meadows to look for the orchids, and every knoll that is congenial to the columbine and saxifrage? At this season can you find the fringed gentian? Or can you tell how many varieties of aster and golden-rod are within sight of your homes?

Are there any professional gentlemen here, or those of sedentary habits, who are troubled with dyspepsia, and are look-

ing forward to a longer summer vacation as their only hope? Do you know all the species and varieties of trees and shrubs within five miles of your doors? Or have you studied the rocks and minerals which compose these hills, and form these valleys? Probably none of us realize and appreciate as we should the beauty and grandeur of these scenes around us. Bayard Taylor, after having travelled over all Europe, when standing on the top of Powow Hill in Salisbury, is said to have remarked that he never before had seen any thing so beautiful. Why need any of us go abroad in search of beautiful scenery, when Nature has done so much for us at our very doors? Do you in this section fully appreciate your lovely Merrimack, with its tributaries the Spicket and Shawsheen; those hills of Andover; Boxford with her twenty ponds; Wenham and Essex with their deep damp woods; Cape Ann with its unsurpassed drives, its variety of ocean woodland and villa; the shore-towns with their seventy-five miles of seacoast? All these form a scene of beauty and loveliness nowhere excelled, if equalled, in this country or in the world.

Farmers of Essex County, I congratulate you upon this the return of our annual festive occasion. This beautiful day, this large assemblage of friends and neighbors, the fine display of domestic animals and the unusually rich one of fruits and flowers in yonder hall, are all auspicious omens. Let us, then, together take courage for the future. Let us be *enthusiastic* in our work, making the most of our circumstances, ever ready to stand firmly for the right, for morality, for temperance, for good and wholesome laws, not being deceived by the promises of politicians and demagogues; then shall our future be even more prosperous than the past, and we be proverbially the strength and hope of the nation.

THE CAUSE OF HARD TIMES.

WORCESTER NORTH-WEST.

[From an Address by Hon. J. H. Seelye.]

Everybody is inquiring why the hard times came upon us, and how we can get rid of them. Many attribute them to over-production. I don't believe this. I don't suppose, if you look into the matter, that you will be disposed to believe that we were visited with a panic and a period of prostration because there had been an over-production. Would it be good sense to complain of being poor because you had more money than you could invest? Would it be logic to say that you had nothing to wear because you had too many clothes, and nothing to eat because you had too much? No. I hardly suppose the hard times came from our having too much manufactured wealth. Another popular error is, that there is a serious difficulty impending between capital and labor. This is a mistaken notion, I believe. There is no conflict between capital and labor. What is meant by capital? The farmer's hoe is capital. Is there any conflict between the farmer and his hoe?

Capital is that part of a man's wealth or possessions which he uses to get more wealth. There would not be any labor if there were not capital to employ it. Capital is necessary to pay for labor. What in the world is there to set to work all this unemployed labor we see and hear of but the simple enginery of capital? Capital is the essential, indeed, the only, solution of this problem. What is to be done with the idle forces of labor? Why are they idle? For want of capital to employ them, is it not? What will give the forces of labor employment? More capital, is it not? Therefore the man who undertakes to say to you that there is a conflict between capital and labor, I proclaim either ignorant of what he is talking about, or desirous of bringing about a condition

of anarchy and the destruction of all the interests at work in building up this country. As nothing can give employment to labor but capital, it is the first step toward easy times when capital begins to accumulate, as it was the first step toward hard times when the destruction of capital began. How did the panic come? Unnumbered millions of capital were destroyed by the war, by the great fires in Boston and Chicago, by railroad speculations. The destruction, for a time, went on at a tremendous scale, until the capital of the country was exhausted; then, of course, the panic came. Capital and its relations are so evenly balanced, that any disturbance of them anywhere — in this country, in Europe, ay, in China — would affect every man, woman, and child on the face of the earth.

When bankrupts settle with their creditors for thirty and fifty cents on the dollar, who pays the rest of the amount? — for it has got to be paid, just as any debt of nature is paid. Why, you and I pay it: that is the truth. All debts are paid in full, must be paid in full, by somebody. If the bankrupt compromises, he only shifts the burden upon our shoulders. Now the fact is, better times are coming. We have been saving up our capital; and, the more we get, the more opportunity there will be to employ labor. But there is this drawback; and the idea may, certainly can, ruin the brightest prospects of a revival of business industry. Suppose you have never so much capital, and you dare not invest it, but lock it up, and keep it out of sight, what good will it do you? That is the evil.

Lack of confidence on the part of the capitalists will ruin every plan looking toward a brighter future. That is where the danger is to-day. Merchants and capitalists have no confidence in the investment of capital. The thing which, more than all other influences, has brought about this fatal want of confidence is our currency. We have been destroying confidence in the working-power of money because we have been destroying confidence in the value of money. We have undertaken to say that Congress is possessed of a sort of omnipotence, — nothing to do but to issue its "fiat," as they call it, and Congress can make something out of nothing. We have saved from our foreign trade two hundred and fifty million dollars. This is an instance of how our capital is

increasing. But what good will it do us if it is not used, as it will not be until money has a value that cannot be questioned? You cannot make confidence in capital come back while you unsettle the very foundation of its value. Congress can no more make money a value when it has no value, than it can make regiments of pasteboard into fighting men. One idea is as absurd as the other. We are going to have an easy time now, if we can only preserve the credit of the country; and to do this no other course remains but to adopt an unchanging standard of values.

WHAT THE FARM TEACHES.

[From an Address before the Berkshire Society.]

BY GEORGE F. MILES.

Whatever may be said respecting the superior advantages offered to the farmer by other portions of our country in comparison with our own Berkshire, it is well for us to recognize some of the *conditions* of every farmer's success,—conditions, not of fertile soil and of personal industry, but of the *government* under which the farmer lives. Other countries are blessed with rich lands and favoring skies; but such is the government, that the farmer cannot thrive. A titled aristocracy crushes the enterprise and ambition of the tenant, or a grasping monarch pours into his own coffers all the profit from the labor of the husbandman. This is not the case in our own country. Here faithful labor receives, to a large extent, its appropriate reward; while the influence of our political institutions is such, that, if wisely administered, they encourage us to plough, and to sow, and to gather in the harvest made secure to us by the blessings of good government.

The farmer, then, should have the deepest interest in the affairs of state. He has duties as a *citizen*, and these duties are imperative. Too often are they neglected by those whose sound judgment and practical wisdom would give an entirely different direction to the course of the good "Ship of State;" while the names of men called in trying times from the plough to the cabinet bear ample testimony to the fact that the farm is a good training-school for the intelligent citizen and the wise statesman. We wish to consider to-day some of the lessons which the farm teaches the farmer respecting his duties as a citizen. Your farms are yielding you an abundant harvest in flower and fruit and grain;

gather from them other products also, — *lessons* for the wise discharge of your duties as citizens of a beautiful county, a beloved commonwealth, a glorious country.

Our experience on the farm teaches us,

1st, *That the farm will not take care of itself.* It matters little how rich the soil, how excellent the methods of tilling, what improved ploughs and mowers and reapers may be used, the intelligent farmer knows that he must have an eye to every department of farm-work: he must be informed respecting the adaptation of crop to soil and of fertilizer to both, he must have an intelligent judgment respecting the probable result of this or that investment, if he would be successful in his work. Too many farmers travel in the *ruts:* they plant *as* and *where* their fathers planted; they look upon a horizon no broader than that upon which their fathers looked. The wide-awake farmer studies the needs of his farm. He avails himself of the experience of others. He does not sneer at progress in agriculture, but welcomes every suggestion that shall enable him to make the most of what he has. Added to this, is an active, personal interest in the work that every day brings, — an interest quickened and intensified by the thought that the farm is a *mine*, ready to yield its treasures to the thoughtful, careful, and earnest labor of him who works it. But there must be thought and care and labor; and hence we learn that the farm will not take care of itself.

We learn from the farm,

2d, *To retain faithful and tried servants.* These servants are much more numerous than we at first thought suppose. Every tool and implement used in cultivating and harvesting is in an important sense a servant, aiding the farmer in carrying out his plans. It is to the excellence and efficiency of these servants that much of the progress in agriculture has been due; and new improvements in agricultural implements may be looked for in the future, rendering them still more efficient executors of the farmer's will. You learn to look with more than ordinary interest upon these servants, and you dignify them with the epithet "very good." This, you say, is a *very good* plough; that, a *very good* mower. Besides these, there are the living servants, upon whom the farmer is so constantly dependent, all contributing their part

in the ceaseless round of tillage and production, and harvesting and marketing. So important is the help rendered by all these servants, that when you find a plough, or rake, or reaper that "works well;" when you have a cow that makes you rich in the treasure of her golden butter, or a horse that in the nobility of his nature faithfully performs the task imposed upon him; above all, when you find a young man whose excellent judgment, strict integrity, and willing spirit, make him an almost indispensable ally in your work, — then you retain these efficient helpers, and exchange them for others only when you can find better ones than they. Our experience upon the farm teaches us to prize and retain faithful servants.

We learn from the farm,

3d, *That we should not waste.* An observant farmer can hardly fail to be impressed with the fact, that, in the processes of nature, there is little waste. What wise economy is manifested in that force which keeps the heavenly bodies in their orbits, and adjusts for the earth, with unvarying exactness, the appointed change of seasons! There is here no waste of force, but just enough to accomplish the intended object. Nature shows the same economy of material. To use the illustration of another: "How perfectly discriminating, how illustrative of the principle involved, is the difference here between a stem of wheat and the trunk of a tree! As intended but for a season, the one, though adequate, is hollow and fragile; but the other, as solid, has not too much material for the support of its top, and to withstand the storms; and then it is needed, and was intended, as a supply for the permanent wants of man." Does there seem to be a waste of water when "the windows of heaven are opened," and the swollen streams rush madly over their stony beds? These same waters find their way to lake and ocean, to be caught up again upon the bosom of the air, and wafted by the wind to other climes to descend in blessing upon the ground. It is one of the signs of progress in agriculture, that more and more care is being taken in the economy of material. The fertilizing products of our farms are being turned to practical account. The substances constantly furnished in the processes of growth and decay are seen to be the very materials needed to replenish the earth's

exhausted resources; and that farmer is getting the most from his farm who is wasting less and economizing more. Our farms are teaching the lesson of true economy.

We may learn from the farm,

4th, *The powerful influence of silent forces.* How wonderful the silent influence of that power which looses the earth from the icy bonds of winter, causes the snow to disappear from the hillsides, penetrates the earth with the grateful heat, and sends the thrill of life through the countless branches of the forest-trees! All silently works that mysterious power also, by which the mineral is changed to vegetable, and this, in turn, by the noiseless force of nature's alchemy, to animal, thus prepared to become food for man. How mighty, yet how silent, that wonderful power, which, during these passing days, is at work all about us, painting the forests of our glorious Berkshire, and causing them to glow in the light of this October sun in colors so harmonious and beautiful as to defy the skill of the most cunning artist! All these are constantly passing before the farmer's eye, showing him how powerful is the influence of silent forces.

These four lessons, at least, the farm is constantly teaching; viz., that it will not take care of itself, the necessity of retaining tried and faithful servants, the avoidance of waste, the powerful influence of silent forces. Let us see how the farmer may apply these lessons to his duties as a citizen.

He may learn, that, as the farm will not take care of itself, so the State will not take care of itself: in other words, it is the farmer's duty to so inform himself respecting the nature and the needs of the government, that he shall be able to form an intelligent judgment respecting those subjects which are constantly interesting the body politic. He should do not only this, but he should also follow up this judgment with positive action, performing faithfully and fearlessly the duty which as a citizen he owes to the government under which he lives. I call especially upon the young farmers of Berkshire to be politicians enough to have a keen interest in public affairs, and to be as watchful for the good of the State as for the culture and improvement of their farms. I call upon the wives and daughters of Berkshire to allow no false ideas of economy to prevent their

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husbands and fathers from being faithful readers of the *newspaper*, — a regular visitor, I trust, in the home of every Berkshire farmer. It is a good government which has come down to us from the fathers. Let the sterling good sense and sober judgment of the farmers be employed for the welfare of the nation, and many of the dangers now threatening us will be averted.

We need, too, to retain tried and faithful servants in the service of the State. Why should not this lesson which the farm teaches be of service to us in the affairs of government? Shall the wisdom and efficiency which come from experience go for nothing? We do not act upon this principle in our private enterprises; how much greater its importance when the far-reaching interests of government are at stake! Our county has furnished a notable example of one who for many years has faithfully performed the duties of a responsible public position. You have but lately followed him to his last resting-place. Fortunate Berkshire, if another can be found in whose veins courses the same faithful and honest blood! And I need but remind you of that other citizen of Berkshire, who for so many years graced the chair of the governor of this Commonwealth. He wore no collar; but he wore the ornament of an honest and faithful devotion to the duties of that position to which he was so heartily and so frequently called. With such examples before us we ought not to doubt the wisdom of retaining faithful public servants in the service of the State.

The lesson of economy, also, should be carefully applied to the affairs of government. Why does Nature so plainly utter her teaching upon this point, unless it be that we are to apply these lessons, not only in the management of our private business, but also in the wider sphere of governmental policy? In times like these, when the burdens of taxation are pressing so heavily upon all classes of our citizens, and when men are studying carefully the means by which private expenses may be lessened, there surely ought to be equal care in securing the strictest economy of force and material in carrying out all public enterprises. Our individual influence may seem feeble; but the thousands are made up of the units, and no farmer should allow his voice or his vote to be silent upon questions involving expenditure

of public money, or the management of important official trusts.

One that has Nature's teaching so constantly before him must surely be reminded of the forces at work among the masses of our people, and through them affecting the government itself. The *press* of to-day is one of these forces, powerful in its influence, and not less effective because so silent. The noisy demagogue and the blatant declaimer, in their tirades against social order, are not so much to be feared as those products of a corrupt press that strive to array labor against capital, to evade by specious argument the sacred promise to pay, to clothe vice in the spotless robes of virtue, or to desecrate with foul suspicion and distrust pure Vesta's holy shrine. With equal power the press may exert its silent influence as the effective ally of an unselfish patriotism, and of public and private morality.

Education is another silent force, working with mighty power, expanding, elevating, ennobling, the minds of the people, and fitting them to be intelligent citizens of a great republic. The family, too, is performing its silent yet powerful work in training those, who, if they would govern well, must first learn to obey; while religion, with its silent yet beneficent ministries, is ready to bring all hearts into loving subjection to the one perfect government.

These and other silent forces must be recognized by the citizen-farmer. Those which tend to destroy the government founded by the fathers must be held in check, and overcome, while every influence must be fostered that shall make the government permanently prosperous and powerful.

We have thus considered some of the lessons that the farm is teaching the farmer respecting his duties as a citizen. If these lessons are heeded, the farmer will perform more faithfully the duty devolving upon him, while the government will receive renewed security and strength.

NEW-ENGLAND FARMING RESTORED.

[From an Address before the Housatonic Agricultural Society.]

BY PROFESSOR S. T. FROST.

The first product of American agriculture, the first that expanded into an export, came from the Virginia tobacco-fields. Rich and quick profits stimulate culture; and the hungry, exhaustive tobacco-plants fed upon the richness of the forest soil with all the insatiable greediness of Solomon's "daughters of the horse-leech." And when they dropped off, gorged from the drained soil, the Old-Dominion planter, like Milton's shepherd, found "fresh fields and pastures new." The terrible method passed over the land like locusts, or a fire, leaving individuals very rich, but a community of these same individuals very poor. And finally, in less than a century, the poverty of the State has re-acted upon the individual; for no State can long be rich if the lands are poor, and the farm, the farmer, and the Commonwealth are all poor together.

I have located my illustration in another State, for obvious reasons. It is better to philosophize on our neighbor's faults than on our own: we get the advantage of broad perspective which distance gives. "'Tis distance lends enchantment to the view." But seriously, we might have found an illustration nearer home. Those magnificent reaches of hardhack, those extended vistas of white birch, that are covering so many hillsides of old New England, are first-cousins to the scrub pines that sing the requiem over the Virginia tobacco-field. They cover lands not worn out maybe, but substantially flung away. To a New-York or Pennsylvania farmer, — the third generation, perhaps, on the family homestead, — the present condition of a large part of Massachusetts is a standing puzzle, a perpetual surprise, and all the more incom-

prehensible because the State has such large portions under such splendid cultivation. For I take it the oldest farming, and perhaps the richest farm-lands, in the Union, are found about Northampton, in the Connecticut, and also in some of the towns of the Housatonic Valley. Such a puzzle was it to a New-York friend, my companion in a carriage-ride, "What is the matter?" he would ask. "Why is not this land under cultivation? Price?" — "No: you may buy it almost at your own figure." — "Is there any quality of soil that does not appear upon the surface?" — "The very next field cuts two tons of hay to the acre, and you may see the heavy sward under the hardhack." — "Health?" — "It is the healthiest region in the world." — "Market?" — "It has New York on the right hand, and Boston on the left." — "Society?" — "Why, you are in New England!" — "Morals and education?" — "Why, you are in Massachusetts, where such things are devised." It was a conundrum, and he gave it up. We need not wonder; for taking together price, products, society, markets, health, location, it may be affirmed that it can compete with *any region in the world* in opportunities for that legitimate culture of the soil which brings what is now most needed, — a living, maybe cash, surely character, and capital in real estate.

The Virginia pine, the Connecticut white-birch, or the Massachusetts hardhack, alike stand for two of the three stages of agriculture, if the use of that noble word in these stages be not premature. First the settler uses, and uses *up*, the vegetable mould which Nature bestows as a free gift for a start, — a kind of gift breakfast; for, says DeQuincey, "a man may earn his dinner, but breakfast must be a gift." A man without his breakfast is a poor spiritless creature, and in no condition to earn one. But this first gift is soon consumed. An old history of Berkshire County says that the first settlers feared that they would have no building-material, so deeply were the stones covered by the richness of forest mould. It was not, probably, a literal fact; but it stood for a very important one. Farming at this stage is a kind of careless, easy appropriation of Nature's offerings, a simple picking-up of gifts thrown down, with as little skill or science required as of the pigs under the beech-trees when the forest itself shakes down for them its ripened mast. Then

comes the second stage. From this free giving comes wastefulness, then leanness of soil, then emigration and desertion, then sedges and broom, white-birch and hardhack; and the land is ready for its third degree. And this is the point where any thing like true farming begins; the period where economy, labor, and science all take hold and pull together; where, for the first, great yields are invariably and universally produced; when the farmer accepts the facts of his calling, and, without excluding comforts, adapts to it, if need be, his style, living, in short, his expenses,— this third stage, we say, a point which mature civilization always reaches, where necessity compels the only farming that will pay; and this will be the method of "New-England farming restored." What, now, are the strong points, the characteristics, of this method? Take first, not theories, but existing facts, carefully prepared and supported. Take farming in England, or, where it is better still, in Belgium or Holland. (And who shall say that we are not equal to our fathers?) The average wheat-yield of England is thirty-three bushels to the acre, though it frequently runs higher. The Channel islands, Guernsey and Alderney, have produced seventy-two bushels to the acre. Was this fancy farming? No, it was only sharp work for the living of the family. Was it done by new specialties? No, but by the most careful use of old facts, and resources that are universal. By judicious fertilizing the wheat-head was doubled in length, and then the stalk was strengthened to sustain it. It is by saving every drop and every spoonful, nay, every *odor* that will fertilize, keeping the breath of death from the lungs and blood, and turning it into sweet food for the stomach. Especially are the liquids of the cow-stable, horse-barn, and dwelling, all utilized. A gallon from the first, a quart from the second, and a pint from the third, are each equal in value.

Literally, *every thing* that has been once used by Nature or man takes another degree in the great round of going and returning.

In matured communities, and countries like England, indeed Western Europe in general, where a settled order, a final condition of things, may be supposed to exist, land is regarded more as a place to hold the seed, and, in the same thought, the fertilizer. Far less reliance than with us is

placed upon the natural strength of land without manure. And this is in the main the correct theory. The vegetable mould of the primeval forest is soon consumed. Nay, the richest farms by far, — those which support the greatest numbers to the square mile, — the Belgian plains and the hollow lands of Holland, brought no dower from Nature. They were plains of moving sand reclaimed from the ocean, and the soil or foundation was held down by a spread of seaweed; then patches of clover were coaxed in, then a sward, then a garden, — four hundred and seventy people to the square mile, and a cow to every two acres. It is a rule with them that every individual, brute or human, every resident of barn or house, should answer to the fertilization of one-half of an acre of ground yearly; and it is a rule that health, economy, nay, decency, demands. In the common practices of drainage or sewerage we hardly know which to condemn first, — its *waste*, its *filthiness*, or its poisoning. If Heaven were to give us a special revelation, and we should presume reverently to anticipate its character by judging from human needs and human suffering, it would settle no vexed questions of faith, start no new dogmas, open no new doors to the spirit-world for those who are imitating young John Chivery, who, as Dickens tells us, caught cold in one eye by peeping through the keyhole. No, it would rather unfold to mankind that wonderful miracle of mercy and beauty by which all that the uses of human life and nature have rejected should be kept from befouling water, and poisoning air, not only with typhoid and cholera and diphtheria, but that these same germs and exhalations of death should inbreathe themselves, and pass by the wonderful processes of Nature, into the richness and sweetness of fruit and food; for it is only the very dregs of the sewer's festering foulness that can give that exquisite tint to the veining of the cabbage and beet leaf that shames the set of the Tyrian purple in Cæsar's robe. It is only when the suckers of plant-life have digested the scum of the cesspool, and the flowers' lungs have drawn in the mephitic exhalations, that we may say with the Song of Solomon, "Awake, O north wind; and come, thou south; and blow upon my garden until the spices thereof may flow out."

I hope I am not expected to set forth many specific meth-

ods. "Drive a nail where it will go" is a proverb of our race older than our nation. Farming as a business is peculiarly, perhaps painfully, practical, especially about the summer solstice; and he who essays to show by theory how to make it more practical still must expect to face a criticism that has in it more common sense than charity. Woe to him if he make *one* weak statement, though sound on the ninety and nine! He sins once, and is judged for all. The Calvinistic Catechism would not condemn him quicker, and not half so hopelessly. A young Scotch dominie was once settled over an old Scotch parish: he had an honest hankering for teaching his flock agriculture as well as theology. An old mentor of a sexton, who had no fears for his parson's orthodoxy, but felt that he was "shaky" in that rarer science, "how to get along with people," gave him the advice that Douglas Jerrold, in "The London Punch," gave to young people about to marry, — "Don't; for," said he, "they'll see ye ken naething about farming, and they'll get to think ye dinna ken any thing." And the question, How shall your speaker escape the imputation, always in reserve for the theorist, is serious beyond personal reasons. Will it help his case with those he most desires to reach, to state that he was one of three, who, in the last harvest, cradled down eighteen acres of grain in two days? Not that he considers those days worth telling of for purely personal reasons. Oh, no! "I think not of them," said Macbeth, when Banquo reminded him of the royal promise of the three weird sisters; though the truth was, he had been thinking of little else. There is something wonderful in the faith of writers and speakers on agriculture in their ability to make converts to farming, especially of the young men in the fresh flush of early ambition, by depicting the beauties and profits of farm-life. There is, indeed, no more unpromising subject for gush and bosh than a farmer's boy. The actualities of life have sharpened his mental perceptions, and taught him self-reliance. "There is an animal," says Charles Reade, "of no great merit, but with the eye of a hawk to detect affectation: it is called a boy." But this much, at least, may we claim for farm-life: if the long week-days of summer call for terrible toil, — the labor even of a slave, — if spring and fall are as busy, barring the heat, winter affords the best form of

leisure, for leisure is not emptiness. And nights and sabbaths in the country, if fences are good and debts are paid, are nearer rest than any thing else with which God ever blessed this weary earth.

I assume that very little American farming has reached this third stage: New-Jersey garden-culture is the nearest approach, — the degree, I mean, where waste can no longer be afforded, where a settled occupancy and crowded population compel earth and man to do their best. I believe it will be the mission of New England, in "New-England farming restored," to develop and propagate this higher culture. "Every principle of civilization," says Guizot, "before it can be of any use to Europe, must first pass through France." So New England has given birth and early strength to opinions that were one day to become laws, though New York has had an equal work in crystallizing them into codes: so New England has originated the methods of American labor. And when we reach the point where new lands can not or will not be sought, but old lands restored, the skill, enterprise, economy, and capital of New England, will be required and found ready for the work. *Brains*, too, are needed for a good crop. "How did you raise those cranberries?" was inquired of one who had the premium crop. "Brains," was the brief answer. "Where on airth," was the next question, "did you get brains enough to kiver a cranberry-mash?" Skill and economy too, and not expenditure for costly manures. "John," said his lordship to his farmer, — "John, do you know that the whole strength of a cord of manure does not weigh seventy pounds, and that the rest is useless? John, the time will come when the fertilizer will be carried to the field in one pocket?" — "Ay, your lordship, and the crop brought back in the other."

And now may I be pardoned — nay, I shall ask no pardon of man or woman for the truth I am about to say — for indicating the evil which reaches widest, and strikes us deepest; an evil that is giving over our national character, religion, and life into foreign hands? I do not mean intemperance, with disease, madness, ruin, and death for its executors, for its curse compared with this is only a specialty; it is not the lack of faith, to which tendency the New-England mind, they say, through its activity, predisposes itself; not the betrayals

of trust, — the many revealed and the many more yet hidden, — until the country turns in sorrow, like Washington to Lafayette after Arnold's treason, saying, "Whom can we trust now?" None of these: it is the childlessness of our New-England homes. Often it stands for bereavement, but far oftener for nameless crime, which blasts a nation's life, which is shaming, by comparison, our Protestant church and faith, hardening the human heart into irreverence for human life in all its stages. Even though life were sometimes crushed out by its appointed and assumed burdens, it is better to be Abel than Cain.

Farming in New England *must* be restored. We shall not be coaxed, but compelled. We are not now using persuasion, but prophecy; for we are fallen upon days when necessity, not preference, rules: and when necessity takes the form of human progress, compelled by the laws of Providence, who would wish a better master or guide? Prices, products, location of land, elsewhere will compel its cultivation. The West is not all a garden or a river-bottom. There are portions whose exhaustless soil and favored location defy competition; but the exceptional instances are now rare. Again: no one State will ever have the monopoly of manufacturing that Massachusetts once enjoyed. The Merrimack may continue to drive more machinery than any other river; the Housatonic pushes its magnificent mill-power down to the ocean: but the Mohawk, the Genesee, the James, and the Niagara sending its compressed air to Buffalo, are at least rivals.

Especially must Western Massachusetts have some readier way to the coal-fields, which way at the same time shall give another outlet to Berkshire. There is no prospect more hopeful than, no other opportunity so open for our advantage as, that which lies in the fact that we are no more than twenty miles from a point where two railroads, — the Dutchess and Columbia, and the Rhinebeck and Connecticut, — crossing only a single county, lead to the two great coal-depots of America, — Newburg and Rondout. Why could we not build our Massachusetts Central in Massachusetts, and not in Connecticut?

Through what a long desert the nation has passed, of barren hopes, and toil that bore no fruits, when the sweat

of the brow seemed to claim in vain the privilege of the curse in earning bread, — a desert way where heaven's omens seemed reversed, the fire by day, and the cloud by night!

Better times! What have we in mind when we use this term so freely? We shall put up, doubtless, with what comes: we have a way of doing it. "Was your wife resigned?" asked the minister of the bereaved husband. "Ya, dominie, she *had* to be." But there is a wisdom, and probably some comfort, in fixing it in our minds beforehand. First, are not the times meeting us at least *half* way? They will grow better whenever we are willing to adapt ourselves to them; and herein lies the solution of the problem, not in special devices of legislation. Do better times mean days when there shall be no need of diligent labor, and strict economy, and actual values? Is it not true that every one of us has enough for every real comfort, with luxury enough for his own and his children's good? Prices will probably improve, sales become quicker, and exchanges more brisk; but, unless we are in some way independent of laws which human experience everywhere reveals, nine-tenths of the world live and will live plainer lives than we are now leading. Or does it mean that we shall inflate our pockets with promises, and then by mutual *prestos* become rich?

But neither coaxing nor compulsion will make all our sons farmers. Nature does not make the nest to hold the full-fledged birds; and through the same law come to the minds of the young and strong those feelings of unrest and ambition,

> "Which in part are prophecies, and in part
> Are longings wild and vain."

It is the old fact of the fable of the Athenian youth and the labyrinth: some find the thread that guides them safe, others are bewildered and lost. A ratio based on the proportion of births and deaths in our large cities terminates in less than a century. In ninety years their life would run out, and busy streets become dumb as churchyards. All this terrible deficit must be made up by blood and bone and muscle bred on country hills. Not one in one hundred who do the business of great cities was born in them. But New England is singularly, wonderfully fortunate in the compensations which come back from these very losses to her coun-

try towns, — those "brood-combs," as Beecher calls them. How many who have been thus sent forth to positions of power through health, or wit, or wisdom, have made it their mission to benefit their birthplace, the church where they learned the fear of God, the school where a better ambition was awakened, the poor above whose level Providence has lifted them, the old homestead and farm where they may show "New-England farming restored"! Ten years of rest after the hard labor of life, ten years of old age to live over again the life of early years, ten years of reflections and making ready, and then a peaceful burial at one's birthplace, is a blessing that many have enjoyed in hope, and a few in reality. There is a Scandinavian legend of a boy who used to go down from his father's hut to the rocks by the ocean-side. There he saw the great ships of the sea-kings go by, and his heart swelled within him like the mountain brooks, and he longed to become a viking. He sought the sea, and became the foremost viking of them all. His name was a terror to both coasts of the channel. He conquered for himself a kingdom in sunny France, and built a lordly palace and pleasure-house among the vineyards and apple-blossoms of the Seine. But the pride of power soon wearied; flattery lost its charm; his heart grew sick with public care, the fickleness, the ingratitude, the cowardice, of friends; and the voices of childhood filled again the dull ear of age. All day long the goats bleated for him; he heard the sweet, sad sighing of the winds in the hemlocks, the pulsation of the surges against the rocky shores; he longed for the quiet of nature, —

> "The silence that is in the starry sky,
> The sleep that is among the lonely hills."

He "gave his honors to the world again," came back to the hut of his childhood, ate again the barken bread of Sweden, and drank its bitter beer; and when the last hour came he was carried down to the rocks by the ocean-side to die. "Bury me not in Egypt," said good old Jacob; "bury me with my fathers, I would lie in their burial-place."

CLEARING A FARM OF BOWLDERS.

ESSEX.

[From an Essay.]

BY JAMES J. H. GREGORY.

Bowlders are the large stones, weighing from a few pounds to many tons each: they were more or less rounded in the course of their transportation from their parent ledges in the North-West, long before man was created, as geologists tell us, — such stones as we find on nearly all the farms of New England that are not along river-courses, and of alluvial formation. These are the stones that have given New England her network of stone fences, and which, when they abound on the surface, are considered in the popular judgment as indicating soil of good natural capacity.

When on or near the surface, every farmer finds that they interfere seriously with the cultivation and harvesting of his crops. They are in the path of all horse-work; they are the nuclei around which gather bushes in the mowing, and weeds in the tillage; they consecrate a large area around them to waste, where the plough never enters, and stones and general refuse accumulate; they are unsightly to the eye, and, in the judgment of him who would buy, hold a first mortgage on the premises; and finally, in the same proportion as agriculture progresses, all these objections grow in emphasis.

Shall the bowlders be removed? The hard-worked, practical New-England farmer replies by a counter-question, — "Will it pay?" If a man has any leisure, of course it will always pay to invest his time in improvements; but if clearing his land of bowlders means giving time that the farmer recognizes other calls for, and especially if it means the employment of hired help, then the question becomes somewhat

complex. When time given to this work means money, on many farms it would be cheaper to invest what it would cost to clear land of bowlders in the purchase of land already cleared, the farmer showing practical wisdom, under such circumstances, in planting his bowlder-covered acre to wood, throwing it into pasture, or still continuing to do the best he can with it, under the circumstances, as tillage.

There is, however, a large class of farmers, whose land — either from its natural quality, or from its vicinity to a market — is so valuable, that they are led seriously to discuss the practicability of removing these hereditary obstructions to their progress in thrifty farming. To that class I address myself. Let us examine the bowlders as to their size, their number, how they lie, — whether mostly above or below the surface; for digging around them is one of the serious items of cost, while those deeply sunk never blast as well as those near the surface, and when blasted require extra work to get them out of their deep beds. Again: we should regard the kind of rock they are of; for the granites smash up far better than the rocks into whose composition hornblende enters.

Finally, the value the rock may have after removal is to be considered, either to the public for building-purposes, or to the farmer himself. Sometimes this may come by using the rock for building some long-needed house or barn. Having had to consider some of these points on three of my own farms the past three years, while removing thousands of tons of bowlders, I will present my method of dealing with these hard-headed obstructionists, with what experience has taught me, always ready to light my taper at the lamp of any of my fellow-farmers whose experience may supplement my own. The man with some patent lever will be apt to come along about the time you begin to start your bowlders, — a something to lift the bowlder from its bed after a couple of stout hooks are fastened to it by holes an inch or so deep drilled into the rock. Some of these save-labor contrivances are good in themselves; but my experience teaches that whether they are of value to you or not turns on the readiness with which you or your foreman take to the plan. For instance, one man will hit at once the knack of drilling these holes at the right angle, so that the hooks scarcely ever draw out; while with another the hooks as often as not draw out.

With me the lifting apparatus has not proved a profitable investment; while with my next neighbor it has worked well. After various experiments I have found it more profitable to let out the uncovering and drilling as piece-work, paying a price per inch for drilling, which includes uncovering also, when the bowlders need blasting; otherwise, then a special price for uncovering.

At the present time I pay six cents an inch, find powder and drills, and pay for the sharpening of the same. I have no doubt but that to many this reads like very good wages; and some shrewd Yankee who is reading this is itching to get his pen and ink, and offer better rate, with the idea that there is money in it. By the old-time way of blasting there would be very good wages to be made at these rates; but there has been a change in the character of explosives, and of these I have availed myself. My bowlders are of all sizes, up to twenty tons to a single stone; but those we blast average about four tons' weight. The average depth of the holes drilled was at the start about ten inches; but, with increased experience and improved explosives, the depth has been decreased to the average of about five inches, while the diameter of the holes has at the same time been much lessened. The explosive I now use is rend-rock, — an admixture of gunpowder, while in a pasty state, with nitro-glycerine. This powerful explosive, though well known and very generally in use by contractors on public works, is yet so little known by farmers in general, that I think it will be worth while for me to give them an introduction to it, as its use enters so largely into the economy of handling bowlders.

Rend-rock is sold (I get mine of George H. Sampson, 25 Congress Street, Boston) in paper cartridges of various sizes, at the rate of fifty cents for lots under fifty pounds. It is fired with powerful caps, which cost two cents each. The material is generally used by tearing open the cartridge, and taking as needed. As will be seen, it is over twice as costly as common blasting-powder; but, as every farmer knows, the great cost in blasting is the drilling, and this is where the saving comes, as it will do as much execution as gunpowder in a hole of one-third the capacity. Again: it can be loaded far more readily; push it down hard with a stick, and, inserting the cap, fill up with any coarse soil at

hand, giving it one or two sharp pushes down with the same stick; put a few handfuls of earth above, and any forty or fifty pound rock at hand on that; then, on firing, stand a good distance from the hole, as the rocks fly more than with common powder. There is capacity in this explosive which is wanting in gunpowder, — that of blasting a rock by putting it on the surface when any appearance of a seam can be detected.

I have had bowlders weighing ten tons, and very solid and hard ones too, knocked all to pieces without any hole having been drilled in them, the first attack being made in a small crevice just large enough to receive a quarter of a pound of rend-rock, which was plastered in there by hand, just like so much mortar. This "strained" an opening into the rock; and two more blasts finished the monster, reducing him into pieces so small, that a single horse could handle the largest one. The capacity of smashing into smaller pieces, I find one of the good traits of rend-rock. The extra power becomes of value in enabling one to do in a single blast what gunpowder would require two to accomplish. I had two such instances this morning, where fragments of two very large bowlders were left in their respective holes that were too near the surface, and needed removal: cartridges of rend-rock thrust between them did the work capitally when there was not working-surface sufficient for powder to have done any work. As to any extra danger from this compound, there is none to any man of common prudence, who knows how to treat a cow as a cow, and a horse as a horse. Full instructions, with necessary precautions, come with the material; and, if desired, a man is sent to give practical illustrations.

Having reduced our bowlders to fragments that cattle can handle, what shall we do with them? For myself I have no market for them. Having used up all needed for cellars, there still remain thousands of tons to be handled. My way of handling them is set forth in the wisdom of the old proverb, "Make one hand wash the other." I need, as every farmer does or should need, more or less soil for my compost-heaps, amounting to some hundreds of cords annually. Having used all the waste that ditches and other resources afforded, I was driven to my pasture-land, and had begun to make

unsightly holes that pained me to look at, when a resource occurred to me in the various roadways of the farm leading to the different fields. I remove the surface-soil as deep as of value (and for compost a portion of sand or hard-pan does no harm as an absorber of liquids); then dig a sufficient depth into the gravel to receive the bowlders, tumble them in, fill up the spaces between with the smaller rocks which I take from some of the too many walls, level off with the smaller stones, and finish with the gravel thrown out of the roadway.

I could not afford to blast these bowlders to make a roadway, nor to make a roadway simply to get rid of these bowlders; but the compost material is the happy make-save, while at the same time I get a splendid road, completely underdrained, that knows nothing of the coming or going of frost, but is always as magnificent a road-bed as the famous highways of the ancient Romans. If it were merely a question of sinking bowlders, and thus disposing of them, I question whether this would not still be the more economical way of management: for I have found when single stones are handled in this way, that to make sure of getting them at the right depth below the reach of the plough, it is necessary to dig a hole much larger than the bowlder, whereas in the excavated roadway there is far less waste; while the digging, that is necessarily all spade and pick work in individual holes, here is mostly done by the plough. If, in handling blasted rocks, I find some with good building-faces, these I haul into some waste angle to avail myself of their possibilities. This is the best paying way I have yet found for disposing of these obdurate tenants-at-will, whose principal business since the coming of civilization has been to break or wear away plough-points, and strain the patience of industry. The other day I studied the record of a single stone measuring two feet by two and a half. On its hard greenstone face, located just below the surface of the soil, I counted, side by side, as close as they could stand, over forty well-defined grooves made by the points of ploughs, all along down from the ancient Puritan days to the present year of possession. With feelings somewhat allied to indignation, I pitched that stone into the bottom of my roadway trench, and so closed the record.

NEW-ENGLAND FARMING.

WORCESTER SOUTH.

[From an Essay.]

BY N. S. HUBBARD.

The saying is so often repeated, that "New-England farming does not pay," that it becomes a question of serious consideration whether the farm should be abandoned, made secondary to other industries, or receive our more careful attention. It is a settled question that farming is the foundation on which all other industries are built. I shall assume — and not only assume, but lay it down as a fixed thing — that farming does pay; but whether it receives its due reward in comparison with other industries for the labor and care bestowed is not so fully settled. One thing is sure, it is the oldest employment of man: through all time it has received its due share of attention. Massachusetts has a large population to be fed from the products of the soil; and, if the needed supplies cannot be produced here, we naturally turn to the Great West. Can we afford to neglect the cultivation of our own soil, and rely upon the productions of other sections to supply a demand that exists in the cities and villages dotted all over our own State? What does the West produce? Chiefly wheat and corn, beef, pork, and wool. If New England cannot compete successfully with these productions, she can do very much in that direction, and at the same time turn her attention to the production of other things that find a quick and ready market.

There are many things that must be produced within a reasonable distance of market. Milk cannot be safely put into our Eastern market, to any great extent, from beyond the borders of our own State; so that much attention is

turned to its production here. Now, what are the facilities for doing it? The cow must have good food and a plenty of it: can she have it from the products of our own soil? The principal food for the cow, and the food to be relied upon more than all other, is grass and hay. Can this be produced here so that we can compete with the West in this product? I answer, Yes. Our soil is even better adapted to the growth of grass than the lighter and more porous soils of the Western prairies; so that we have the grass for the summer, and the hay for the winter food. And in no section is there made a finer quality of butter and cheese than in our own. If we add to these the product of milk for the market, we find it a good source of revenue for the dairy community.

And this leads me to consider this important New-England crop a little further. Pasture-lands, for the production of summer food, are not improved so much by cultivation, or the application of top-dressing, as the mowing-lands; still they may be very much improved in their productiveness by keeping down the brush, and the application of plaster or ashes, which will greatly improve the quality as well as the quantity. But there is sometimes a deficiency in the supply of grass for the summer food, which must be supplied with something else, such as fodder-corn, Hungarian grass, cabbages, or grain.

When we leave the pastures, we turn our attention to the winter food or its production, and the mode of using. The chief dependence is hay. Statistics show that the average yield of hay in Massachusetts is about a ton per acre; while in some cases it is reported that seven or eight tons have been produced upon an acre in one year. There were cases where land was in the highest possible state of cultivation by giving it a bountiful supply of top-dressing. The common practice is to crop too much and return too little. All subtracting and no adding is as sure to diminish the productiveness of the soil as in the diminution of dollars and cents. The sacred page tells us, "Give, and it shall be given you." Give to the soil, and the soil will give to you. This is the great law of compensation. The soil cannot be cheated in its supply of plant-food, and make good returns, any more than animals can be cheated of their supply of food, and still thrive well. But how shall this plant-food be supplied in

sufficient quantities? I answer: To a great extent by making and saving all the manure possible, and applying it to the soil. Watch for every place where there is waste, and contrive some way to turn it to the best account.

I have spoken of the grass-crop. Corn, potatoes, the smaller grains, fruit, and vegetables are produced, and may be, in much larger quantities, besides beef, pork, and the products of the dairy. Corn, perhaps, may not be grown as a specialty; but to ignore the crop I think far from the part of wisdom. Many say, "We cannot afford to raise it." Can we afford not to raise it? Let the farmer plant what he can attend to while looking after other crops, and he will find at harvest that he has secured a valuable crop, without feeling the expense to that extent that he will to purchase that amount. And while we are securing the corn we are also having a large amount of fodder for winter use. Let every farmer ask himself the question: "Am I not neglecting a valuable and important crop?" Barley, rye, and oats can be successfully grown upon our own soils, and it should be the careful study of every farmer to know what crop is best adapted to his own particular soil. Small-fruits and vegetables are grown with eminent success in many localities, and are found to be a source of large income. This should be done near enough to a market, so that the crop can be disposed of without the draft of the middle-man upon the income therefrom.

The dairy is a very important interest in our own State. There is probably no place on the face of the earth where better butter and cheese can be made than here; and, while this is an important part of the product of the farm, it has not received that share of attention which its importance demands. The farmer should study carefully to know what breed of cows is best adapted to his particular farm or locality, and for what he is producing milk, — whether for the market, or for butter and cheese. If it is for butter, then the milk must be rich in butter qualities; but, if for cheese, it must have qualities better adapted to the manufacture of cheese. Careful analysis shows that the best butter cow is not the best cheese cow, or the most profitable for the production of milk for the market. In the one case the cream or buttery particles or globules will readily separate,

and when removed leave a very poor quality of milk; while in the other case, when all the cream is taken off that can be separated, there is much more of the caseine or cheese quality left; so that it cannot be truthfully said that the good butter cow is the only one that is valuable for the production of milk for other purposes. There is such a vast difference in the quality of butter, that its manufacture and preparation for market become a question of great importance to the farmer, and one that essentially affects his pocket.

Milk is very sensitive, and readily partakes of any impurities of the atmosphere about it, or the vessels used in its manufacture. If there is a lack of care here, the butter produced will at once notify you of that fact. If all these are perfect, and there is still lack of care in the manufacture and preparation for market, you will have like notice. If twenty or twenty-five per cent more can be obtained for a nice article, then why not every dairy-woman have it, or at least strive for it? There is also this vast difference in the quality of cheese; some being hard, dry, or possessing a flavor that is any thing but palatable, while some is soft, rich, and melting when put in the mouth, and possessing a flavor so delicious, that it commands a ready sale at all times, and a price above ordinary cheese that will more than pay all expense of manufacture, materials used, and marketing. To insure this, several things are necessary: First, the milk must be in perfect condition; and, second, the cheese-maker, whether at the factory or private dairy, must have every thing in perfect condition about the manufacturing and the materials used, such as are absolutely necessary; and, in addition, he or she must have a knowledge of the business, and observe all the operations till the cheese is ready for the market. In order to have the milk in good condition, there must be cleanliness in the milking, never using a wooden pail, as it is much more difficult keeping it perfectly sweet. The milk should, as soon as possible after it is drawn from the cow, be thoroughly cooled, and, if taken to the factory, never be exposed to the sun. If these conditions are not followed, although the cheese-maker may not be able to detect sour milk, there may be impurities enough to change the flavor of the cheese, and thereby lessen its value. The same rules are to be observed at the factory throughout.

I have spoken of the labor of the farm. There is often wanting a well-directed effort or economy of labor in the management of the farm. Formerly every thing was done by hand-labor; but, with the march of improvement in every other branch of business, the farmer has been casting about to see what could be done to lighten his burdens, and has brought to his aid machinery and improvements in the tools used, so as greatly to lighten his labors, and render his occupation far more desirable.

There is not that shrewdness on the part of farmers in the management of their business that there seems to be in other branches of industry: there is a lack of combined effort in affecting sales of farm-products, and thereby securing better prices. Every farmer seems to act by himself and for himself, without regard to the interests of others, thereby rendering eminent success much more difficult. There is need of careful thought in the production and disposition of farm-crops. It is sometimes said that any one can farm, if he have only the bone and muscle. The steam-engine is constructed with great strength and power when properly directed: it needs the same brain-power to direct the bone and muscle, so that every blow will tell to the best advantage, and so, also, that the farmer may be quick to adapt himself to circumstances as they shall arise. There is a fixed rule for the production of many things, and the expense can be very closely calculated. Not so in farming; there are so many attending circumstances, such as heat and cold, wet and dry, or insects destructive to vegetation if the battle of extermination is not successfully fought against them; there is, also, a battle against weeds, which, if suffered to predominate instead of the intended crop, are continually drawing the plant-food, which is just as destructive as to take away a part of the animal food, and still have the animal thrive just as well. Clean cultivation is necessary. It is comparatively easy to keep down the weeds, if attended to seasonably; but, if allowed to grow, they are hard to eradicate. A heavy stone just starting from the side of a steep hill may be stayed by simply putting the hand upon it; but, if under full headway, we must stand out of the way. It is so with weeds: if destroyed as they start, it is easy; but, if they are allowed to grow, they become formidable.

CONDITIONS OF SUCCESS ON THE FARM.

WORCESTER SOUTH.

[From an Essay.]

BY HENRY E. HITCHCOCK.

The conditions of success and the methods to be adopted to attain it are so intimately related, that they may be presented together without doing any serious violence to either logical or methodical arrangement. The conditions of successful farming are not essentially different from those belonging to other pursuits: the first that I shall name is, that the business must be adopted from choice, instead of necessity. After a careful, intelligent, and deliberate survey of the whole range of business opportunities, our hero has decided that his tastes, inclinations, judgment, and means point toward farming as the best vocation for him, and he accordingly adopts it. Knowing that nothing succeeds without effort, well-directed and persevering effort, he brings all the energies of his physical and mental constitution to bear upon the end in view: nothing will be done or attempted at hap-hazard. Before deciding whether to engage in general farming, or some special branch, he will consider the questions of the nature and capacity of the soil he has to cultivate, the demand of the market for this or that product, his facilities for supplying that demand, and the competition he will have to encounter. But I must not forget that the man is not the only factor in this problem: the other, and by no means the least important one, is a helpmeet for him in the person of one of the other sex; one who is in full sympathy with his aims and purposes, who will be to him a wise counsellor, a judicious friend, and a faithful helper, in a word, his veritable other self. As a fur-

ther condition of success I must mention the possession of robust and vigorous health by both husband and wife, and also abundant physical strength and mental acumen: all of these are absolutely essential to the highest success.

A third condition of success is, that the farmer must understand his business. He must know what crop or crops his farm is best adapted to grow, and the best methods of growing them so as to realize the highest results at the least possible expenditure of time, labor, and money. He must know what breeds of horses, cattle, sheep, and swine, will best serve his purpose to supply the demands of the markets of his locality. He must know how to raise, feed, and care for his animals in the best manner; keep none but the best of their kind; know how to buy and sell, and to take advantage of favorable chances for doing the same. He must be able to plan and direct the multitudinous operations of the farm. In disposing of his surplus products, he will, so far as he can, place himself in direct communication with the consumer, thus saving for himself the profits that would otherwise fill the purses of the middle-men. He will be scrupulously and conscientiously honest, upright, and honorable in all his intercourse and dealings with his fellows. He fully realizes the fact that "a good name is rather to be chosen than great riches, and loving-favor rather than gold."

Another condition of success is, that the work of the farm shall be seasonably and properly done. Emphatically the farmer must take time by the forelock. The preparation of the seed-bed must be thorough, and the sowing, planting, and subsequent care and cultivation, must be done at just the right time; no weeds or noxious plants must be allowed to choke the tender plants, or plunder them of the food furnished for their growth and sustenance: for the difference between doing all these things and not doing them, is the difference between success and failure. The farmer will find it for his interest to use none but the best tools of their kind that his means will allow him to procure. He will not regard every new-fangled implement as necessarily an improvement because it is new: he remembers, that, as the proof of a pudding is in the eating, so also is the value and usefulness of an implement determined by a trial, and that trial he will demand whenever he is in doubt as to the working of the thing.

The crops must also be harvested and secured at the right time so as to avoid loss from waste or deterioration. Another condition of success is, that the land cultivated must be brought and kept up to a high state of fertility. To do this the material used must not only be abundant in quantity, but suitable in quality. Nothing better for this purpose has been found than animal excrements, liquid and solid, carefully saved and properly secured, and used either alone, or in combination with other suitable material.

It is my deliberate judgment, formed after careful observation, inquiry, and experiment, that neither science nor art has yet succeeded in finding a reliable and universal substitute for animal manures; and I firmly maintain that the farmer should never allow himself to be coaxed, wheedled, or bull-dozed into an abandonment of their use by the voice of any charmer interested in the manufacture or sale of commercial fertilizers, charm he never so insinuatingly or persistently. I would not be understood as counselling the entire disuse of these fertilizers: some of them may be used to some advantage under favorable conditions of the soil and season; but I apprehend that the profit derived from the use of others has too often been an unknown or a negative quantity. Notwithstanding the protection, either real or imaginary, that the fertilizer law of our State attempts to afford against the sale of adulterated fertilizers, the chances for deception are so great, and cases of failure attending their use are so many, as to justify great caution in regard to them. Moreover, their cost to the consumer seems to me to be out of reasonable proportion to their real value as fertilizers.

The prudent farmer will exhaust the resources of his farm for the production of home-made manure, before expending his money lavishly for the purchase of that which is made, like Dobson's razors, to sell. He will find it much more to his advantage to spend time and money in devising and adopting measures for securing and using the abundant material for making manure that is to be found upon the great majority of our Massachusetts farms. The forests, fields, meadows, and the roadsides even, are rich in such material. If, after using all the manure he can make in this way, our farmer finds that his supply is insufficient, and he feels able and disposed to experiment, it may be well for him to do so cau-

tiously, with an eye to the main chance. Another condition that I will name is, that our farmers must not readily yield to discouragements. Losses and disappointments are the common lot of all classes and conditions of men.

If rain and hail and tempest sweep his fields and forests with the besom of destruction, if disease and blight and insect-pests combine to destroy and disappoint his hopes, let him remember that this state of things cannot always last, that a failure this year may be followed by success next year. Let him, then, possess his soul in patience, relying in perfect faith and trust upon the immutable promise of Jehovah, that "while the earth remaineth, seedtime and harvest, and cold and heat, and summer and winter, and day and night, shall not cease." Let him give no heed to the prophets who prophesy evil things falsely and ignorantly concerning his calling and its prospects. That calling has occupied the attention, and employed the skill and talents, of some of the noblest ones of earth in all ages and in all countries, and will continue to do so to the end of time: it has been, is, and will be, the foundation-stone of the prosperity of nations and of individuals. There are no valid reasons for distrust or discouragement. Let the farmer take counsel of his hopes.

Science and art have already done much to aid the farmer by the invention and manufacture of machinery and implements, by the use of which he has lightened his labors, and secured better results therefrom. By the use of the mowing-machine, the tedder, and the horse-rake, the cutting, curing, and gathering of the hay-crop, is a pastime in comparison with the old methods. The reaper, with its binding attachments, harvests the grain with ease; while the threshing-machine quickly prepares it for the mill or the market. Improved ploughs and harrows aid in the more thorough preparation of the seed-bed; while cultivators and horse-hoes afford the means for rapid and effective cultivation. Chemistry, botany, mineralogy, and meteorology are shedding their morning light upon the pathway of the farmer, clearing away the mists and fogs and clouds of traditional old-fogyism, making the way clear and bright. This light is destined to increase and brighten, until it shall blaze forth in the full splendor of its meridian glory.

FARMS.

MIDDLESEX NORTH.

[Statement of Henry Emery of Lowell.]

The farm which I offer for premium consists of a hundred and twenty-six acres, and came into my possession in June of 1873, too late to cultivate that year. It was originally known as the "Cox Place," of forty-three acres, and the "Butterfield-Varnum Farm," of eighty-three acres; the first-named place being a fine slope of pasturing-land to the south, crossed by numerous walls, and bearing some decayed apple-trees. The other portion is west of this, and divided by the county road. This farm had not been cultivated for twenty-five years, being used for a cow-pasture, and could not support more than six cows at that. It was nearly covered with a growth of pines, birches, and alders, and one-sixth of it could not be traversed by man or beast, so thick was the brush underlined with mud and water. A stream of water starting from the west side, coupled with a water-shed of three hundred acres of land, made it formidable at certain seasons of the year. This brook, which is being carried through the farm in an under-drain, and emptying into the Merrimack River, will hereafter be shown as the first work towards making this land available.

I viewed this land many times during the summer of 1873 to mature the cheapest and best plan for bringing it to a proper state of cultivation. I had before me the fact that it would not pay more than the taxes in its then present condition. In the fall of 1873 I commenced on the "Cox Place," first to put in a twelve-inch plank drain, beginning at the Merrimack River, running along the brook through the "Cox Place," to the west side of the county road to the Varnum land. The drain was sunk from four to seven feet in the earth. The same season I turned over three acres of sod

land, and seeded it down to Timothy, and ploughed twelve acres for cultivating the coming year of 1874. In the winter I removed the old stone walls, and the following summer planted the twelve acres with potatoes and squash, and received fair crops, and in the fall seeded this same twelve acres to Timothy. At the base of the slope was a bog-meadow of some seven acres, where, before the twelve-inch drain was put in, the stream had sprayed over, making it worthless as pasture or meadow. This I attacked next, placing a well at the head, eight feet deep, then running a four-inch tile drain at right angles to the main drain running to Beaver Brook, then connecting two-inch laterals with it sufficient to drain all wet land on the "Cox Place." In November of 1874 I ploughed the same with six heavy oxen; whereas, the year before, it would have been impossible to have driven even one over. In the summer of 1875 I summer-cultivated all of it, carted the hassocks from one-half, and seeded it down to Timothy; also ploughed three acres more to cultivate the next summer, this being the extent of cultivation on the "Cox Place."

On the "Varnum Farm," in the same summer (1875) and fall, I under-drained and ploughed four acres, after digging up and removing seventy-five old apple-trees: all this I planted in the summer of 1876 to potatoes, squash, and sweet-corn, and seeded the same down to Timothy in the fall.

I commenced on the "Varnum Farm," except the four acres above mentioned, in the spring of 1876. The first work was to cut through alders and brush, where water remained the summer through, and to put in an eight-inch plank drain, being an extension of the twelve-inch plank drain through the "Cox Place," at a depth of four feet and a half, and about six hundred feet in length, cutting the brush, and saving about twenty cords of wood from eighteen acres, then completely under-draining all the wet portion of the eighteen acres, and ploughing all that fall. In the summer of 1877 I put in five acres and a half of corn, using chemical manures, four acres and a half of cabbage, two acres of potatoes, one acre of rutabagas, all yielding good crops, except the potatoes: the rest of the eighteen acres were summer-cultivated. In the spring of 1877 I also commenced on twenty-two acres more, immediately west, con-

tinuing the main drain, cutting off pines, birches, and alders, getting about forty-five cords of wood, burning and clearing away the underbrush, putting in a large amount of two-inch tile laterals, and thoroughly draining seven of the twenty-two acres. It was ready for the plough the first of October, and, commencing on Monday to work with four oxen and two horses, I found, after an hour's work, that my team was too weak. On Tuesday I bought a heavy pair of oxen at Brighton; tried again on Wednesday, and still found my team deficient in strength. I procured another pair, making the team eight oxen and two horses, the last investment in oxen proving the best. After ploughing this piece, and turning large clumps of roots, I confess that I felt sick to look at the future; and had not winter set in soon, and relieved me for a few months, it would have been a hard task to have continued it. This year I have sixteen of the twenty-two acres under cultivation to corn, cabbage, squash, and potatoes, which you saw in part at your first visit in June, and all at the September view.

I have this year, in all, under cultivation, about forty acres, divided as follows: fifteen acres of yellow corn, one acre and a quarter of sweet corn, eleven acres and a half of potatoes, four acres and a half of rye, one acre of squash, one-half acre of pease, three-fourths acre of mangels, three acres and a quarter of cabbage, three-fourths acre of parsnips and tomatoes, one-fourth acre of beets, three-fourths acre of turnips: all these, except the potatoes and squash, are looking well, and will be more than an average crop. I have cut seventy-three tons of first quality hay, allowing six hundred cubic feet per ton, and shall have twelve tons second crop. I think that the products of this year will pay all expenses and improvements, which have been considerable, and, besides, leave me a small dividend.

The amount of under-draining on the hundred and twenty-six acres laid since 1873 is as follows: 1,638 feet of twelve-inch plank drain, 870 feet of eight-inch plank drain, 1,130 feet of six-inch plank drain, 1,136 feet of four-inch tile drain, 1,398 feet of three-inch tile drain, 9,002 feet of two-inch tile drain.

The amount spent in improvements and cultivation up to April 1, 1878, would exceed the amount received for produce

by about three thousand dollars. At the time of purchase it would not have been possible to have more than paid the taxes from the income derived thereof, the taxes necessarily being higher than on farms farther from the city; but I do expect hereafter to get a good percentage on the money paid for betterments, and until those betterments are completed.

It will be seen, by the amount of land that I have cultivated since 1874, that a large quantity of manure must have been used; but the method adopted is somewhat different from that generally used by farmers of the present time. I use on strong lands barn and stable manure, and on light land chemical manure. In the use of these chemicals I put on the quantity of plant-food that the crops will take up each year, and replenish where needed in the spring. When barn and stable manure is used, I do not intend to use less than seven cords per acre; nor do I intend to keep land up more than one year, if cultivator and harrow will bring it to a fair condition to seed down. I have not yet turned over any sod that I have laid down, and shall not so long as the roots are strong, and not crowded by their own number. I top-dress the last of April, with a formula of nitrate of soda, muriate of potash and superphosphate, costing seven dollars per acre. In my judgment, there is a change taking place in New-England farming; and he who lives forty years longer will see the same farms produce fourfold more than at the present time, and all derived from under-draining and the use of chemical manures.

WORCESTER WEST.

[From the Report of the Committee.]

Farming at the present time seems to be more popular than formerly, although prices of farm-produce are now much lower than they have been for many years, and taxes are high. But when we see and know the condition and prospects of the merchant, manufacturer, and mechanic, it makes us, as farmers, contented with our business. To be a farmer, and get a scanty living for himself and family, for

want of skill and industry in his occupation, is not the man we wish to own as a farmer. We occasionally know of a young man of means, who has been led to believe (perhaps by some after-dinner speech) that there was no occupation so sure, easy, and remunerative as farming; and, without any knowledge of farming, he proceeds at once to purchase a farm, stock, and tools, and commence by hiring a head farmer. It takes but a few years to convince him that he is mistaken in his business.

Now, for a young man to be a contented, successful farmer, he must possess good health, be a good mechanic, and be industrious: without these qualities, he had better try some other business. In selecting his farm he should be careful to buy good land, without regard to the buildings, as good land well managed will replace poor buildings with new ones; but poor land will make any man poor all his life. He should have some practical knowledge of such kind of farming as he chooses to pursue. He must have love for his animals, also combine neatness with order, — have a place for every tool, and every tool in its place when not in use. He must have a prudent wife, who is capable of making his home happy; for, without an interested head in the house, no man can succeed out doors. Every animal he breeds or puts upon the farm should be of the highest type; he should not be satisfied with a second-class animal. He should also procure the best seed of all kinds that can be found, cultivate no more land than he can manure liberally, and make and save from every source all the fertilizers possible; for herein lies the key to successful farming.

In disposing of the farm-products, sell as near to the consumer as possible, and, in putting up articles for the market, see that all goods are equally good all through; always give good weight and measure: by so doing you can always sell, for the market-price, whatever you wish without any trouble. And whatever goods are to be bought should be procured in large quantities, as near the wholesaler as practicable; but never purchase any thing that is not needed, because it is cheap.

Furthermore, a farmer should take a good paper or magazine for his wife, and the best agricultural paper he can find that has a reliable market-report, and be

active member of the farmers' club, and help support the church.

Every farmer should keep some tools for repairing implements: it will often save time and money. Let him look over the farming-tools in the month of March, and repair and paint if need be. Let him make it a point to take an inventory of all the property, both real and personal, once a year, cash value, and all debts against him. In this way he can tell if he has made or lost in the year's operations.

The question is often asked, Is it safe for a young man to run in debt for a farm? I answer, It is not only safe, but advisable, to a limited extent, say, one-third of the value of the farm. It will have a tendency, as a rule, to make him more prudent and industrious when he has a payment to meet, and less liable to form bad habits with the money by him for which he has no particular use. But he should have but one debt, keeping all small bills paid, cash down.

Now, it is not advisable for a man to overwork, and break down young. It does not follow that the man who works the hardest makes the most money. It is the man who manages best who is sure to succeed. He should devote a proper time for recreation, — such as attending the sociable with his wife, playing croquet with his family and friends; and by all means he should arrange and put in order the most lovely spot on the farm for a flower-garden for his wife to display her skill in cultivating the choicest flowers to gladden the hearts of her household. He should be a liberal contributor to the annual fair, take his family with him, listen to the speeches, and see what practical knowledge he may gain.

It is true, farming is a slow but sure way to accumulate money. But what profit is it for a man to accumulate a large fortune in an unhealthy business in twoscore years, and become a sickly invalid the rest of his days? The very nature of the farmer's business is to promote health. The pure out-door air which he breathes, the good, pure milk, and fresh vegetables and fruit, with which his table is supplied, all conduce to health, happiness, and long life. It is equally true that the farmer has no time or money to go to the fashionable watering-places, as many do who prove to be defaulters or bankrupts, and oblige their honest creditors to take up with ten cents on the dollar.

There were but two farms offered the present year for the society's premium, — one by Mr. John Hancock of Barre, and one by Mr. L. E. Hill of North Brookfield. In compliance with the rules of the society, we visited each of these farms in June and September. They showed and described to us their manner of farming, particularly their mode of making and saving fertilizers, and their application to raise different crops. They belong to that class of farmers who believe in applying brain-work with their fertilizers; they also believe in farm-machinery: consequently, they must clear and smooth their land in order to use the same. They also believe in thorough-bred stock.

Your Committee think, from what they saw, and what Mr. Hancock explained to them, that very few, if any, farmers within the limits of this society have made the permanent improvements upon their farm and buildings that he has made. Mr. Hancock's statement accompanying this gives an interesting account of his improvements, and his crops the present year. While we saw so much to commend, we cannot refrain from saying that we noticed a lack of neatness and order in and around his barn, which should not be allowed on a well-managed farm. Notwithstanding, we are unanimous in awarding Mr. Hancock the society's first premium.

What shall we say of Mr. Hill's farming? We often hear high compliments paid to a man who by his skill causes two blades of grass to grow where but one grew before. Now, we believe that Mr. Hill has caused tons of nutritious tame grasses to grow where nothing but worthless weeds, rushes, and ferns grew before; thus he has increased his income, beautified his farm and neighborhood, added valuable acreage to the taxable property of his town. Furthermore, his motto is to push on with the same improvements. Shall we not call him "blessed"? We were especially pleased with Mr. Hill's management of his crops and herd, but could not approve of his leaving farm tools and machines exposed to the hot sun and rains to become weather-worn. His reason for so doing was, he had no convenient place to house them. It will be seen by his statement, here rendered, that he is entitled to great credit; and we unanimously award Mr. Hill the society's second premium.

For the Committee.

 J. T. ELLSWORTH.

[Statement of Mr. John Hancock.]

I herewith give you a statement of my operations and the result on the farm I have offered for the society's premium. This farm I have occupied for fifteen years. It contains a hundred and sixty-three acres, — twenty-five wood and timber, sixty-five improved, and seventy-three pasture. I commenced improvements immediately upon my occupancy, and have adhered to that policy with steady determination. I have cleared forty acres of stone, ten of which was rough pasture; have laid three hundred and fifty rods of wall, and removed more than one hundred and fifty from localities where I did not want it, enlarging fields, and regaining considerable portions of land. Old hedges have also been removed, and the lands they occupied regenerated. Five acres have been drained with stone. On my pasture-lands I commenced to mow the bushes the first year I came, and have kept it up annually ever since; and nearly every year I have spread plaster or plaster and ashes. The result is, where formerly the bushes were from two to ten feet high, there is very little growth, except grass. Ploughing I think best where it can be done. Other localities mow.

When I came to the farm, I found twenty head of cattle and horses; now I can keep from forty to fifty head. I have built a large barn, and improved the water facilities in connection with it for the stock. The house, also, I have built entirely anew, with the exception of a small portion of frame. Another improvement I have organized since I built my barn: I keep pens for hogs, into which I put sods, loam, and every thing I can utilize for manurial purposes. In August I commence to tie up my cows over night, and daily mix with their droppings loam and sods, bedding them with sawdust and sand. In this way I accumulate a large amount of valuable fertilizer. Another direction in which I have tried to improve is my stock of cattle and hogs. Of hogs, I have the Chester-Whites and Yorkshire, pure bred, and I think either breed well deserving the notice of breeders. In cattle my attention was early directed to Short-horns. I found, however, that the pure-bred cows were not heavy milkers, though grades have proved better. But I started with the idea of getting a pure-bred strain of good milkers, and, not

finding it in Short-horns, I have resorted to the Dutch, and procured a pure-bred bull and heifer, from which I hope to rear a herd worthy any one's care and pride.

These improvements have extended over the time I have occupied the farm (except one year, during which I was disabled), and a due proportion of these improvements have been accomplished within the last three years; for instance, one hundred rods of wall laid, four acres of pasture reclaimed, fifty rods of old wall and hedge removed, beside some minor matters. My stock of cattle consists of one pair of oxen, a bull and stag, twenty cows and heifers giving milk or suckling calves, twelve heifers not in milk, eight calves, two horses, one two-year-old colt, three breeding sows, one boar, and two pigs. My crops for the year are as follows: Eighty tons of hay; six tons of rowen; corn-fodder, two acres; barley, fifty bushels; oats, two hundred and fifty bushels; corn, three hundred and twenty bushels; potatoes, one hundred bushels; apples, two hundred barrels; cider-apples, six hundred bushels; beans, ten bushels; turnips (Swedes), four hundred bushels (flat), six hundred. My dairy being in a transition state from grade Short-horn to grade Dutch, I am using mostly heifers, and have not my usual number, nor usual quantity of milk. From Nov. 1, 1877, to Nov. 1, 1878, the weight of milk made was 87,306 pounds, beside bringing up eight calves. I have sold four thousand pounds of beef; expect to turn off five hundred pounds more during winter. Calves sold to amount of thirty dollars; pigs, to amount of eighty-eight dollars. I do not fatten much pork for market, eight hundred pounds being the extent this year. Other and minor sources of income from the farm, such as chickens, eggs, service of bull, hire of oxen, &c., amount to one hundred and fifty dollars. Wages paid to hired help during entire year three hundred dollars. While I do not imagine the farm by any means finished, I do think I have made many solid improvements on the farm and its appointment and the stock.

Barre, 1878.

[Statement of Mr. L. E. Hill.]

The farm which I enter for the society's premium, situated in the north part of North Brookfield, came into my possession by inheritance in 1859, and is known as the Witt Farm, and contains one hundred and twenty acres, eight of which are in wood, forty-five in grass, fifty-five in pasture, and twelve unproductive, eight of which are reclaimable, the balance is hopeless. Within three years past I have dug a well, and laid an aqueduct from it to house and barn, seventy-seven rods; and have nine places where I draw water, of which there is an unfailing supply, at a total cost of twenty-five dollars, besides material and labor from farm. I have put in sixty rods of blind drain filled with small stone; built sixty-five rods of stone wall; reclaimed five acres of wholly unproductive land (making it equal to my best, and superior to most of my land), mostly upland, bordering a swamp of eight acres, from which the wood was taken a few years before I came into possession of the farm, for the thorough draining of which I have dug eighty rods of drain, and ploughed and taken out the stumps of an acre and a half of it: twenty-five rods more will complete the drain, when the whole will be ready for the plough, and will be equal to the reclaimed swamp of seven acres west of my house. I changed the drain of the barn-cellar from the south (where there was little or no chance to utilize the drainage) to the north end, by digging to the amount of two hundred loads of earth, giving me a large extent of land to spread it over at will, — the most valuable improvement I have made, cost considered (which was less than nothing), getting my absorbents for cellar for three years. I built a granary fourteen by sixteen feet, ten-foot post, at a cost of fifty dollars, cash out.

Within three years I have raised seventeen heifer calves. My dairy consists of nine cows, five three-year-olds, and one two-year-old half-blood heifer, the others grade Ayrshires, having one or more calves each month of the year. From Nov. 1 to May 1 I sold milk and butter to the amount of four hundred dollars: the rest of the year I have sold milk, cream, and butter, four hundred and fifty

dollars' worth. I raised nine calves within the year, and sold two thousand pounds of beef; by estimate (not killed), fourteen hundred pounds of pork; raised six hundred bushels (ears) corn, one hundred bushels oats, sixty bushels potatoes, one hundred and fifty bushels Pennsylvania turnips, and fifty bushels Purple-tops. My hay is estimated at fifty tons, rowen, eight tons. My whole stock consists of thirty-two cows, heifers, and calves, one bull, three horses, one yearling colt.

I employ one man for the season, at a cost of one hundred and ninety dollars and board, and one other two months and a half, from the middle of May, at a cost of fifty dollars and board. I finished haying July 18. I earned out at haying seventy-five dollars. I have no help from children in door or out, my wife doing all the housework, with the exception of three weeks' work of a girl.

SHADE-TREES.

HOUSATONIC.

[From the Report of the Committee.]

If the amount of work accomplished is a correct measure of the benefits arising from a specific purpose, the efforts of the Housatonic Agricultural Society to adorn and beautify the waysides of the county by planting shade-trees is assuredly a success; for your Committee have found, as the *direct* result of the premiums offered for that purpose, more than six hundred trees set in accordance with the conditions of that offer, and *indirectly* the awakening of an interest in the subject that is sure to increase as the good already accomplished becomes from year to year more apparent. We therefore advise a continuance by the society of offering some encouragement, by way of premiums, for improving and embellishing the waysides for the pleasure, the comfort, the refinement, and the benefit, of the *whole* community. If this premium is continued, either every year, or at intervals less frequent, the committee who are to pass judgment upon the claims of the different competitors should be allowed a liberal discretion in making the awards. The size and form of the trees alone should not control their decisions. Location should be considered to some extent.

True, men cannot change the general features of their locations, and hence all could not compete for the prize on equal terms; but then a perfect equality in competition should be subordinated to the general good. No man should be encouraged to plant a tree where it will do no good, simply because he has no other place to plant it. A row of trees, however fine, planted where the mountain or hill rises immediately and abruptly in the rear, loses its effect by the greater prominence of the overshadowing background. So, too, there are places where trees would be decidedly objectionable by

shutting out from view scenery more enjoyable than any that could be substituted by intervening objects. The location and adjacent surroundings should be taken into account also in deciding *what kind* of trees to set. If a tree is to form the frame and adornment of an already pleasing picture, a very different kind would be selected from one designed to form a picture of itself. Happily the variety indigenous to our soil and climate is ample for all situations. The elm, with its open top, its long, slender, gracefully-drooping branches, the ash, with its more rigid boughs, and the maple, with its dense foliage and protecting shade, are types of the various kinds that are easily obtained, hardy, and of rapid growth. A very little artistic taste would decide on a proper selection, if the individual will look beyond the present time, and beyond the leafless, branchless stick that he is putting into the ground, and see in the distant future the majestic tree under whose branches his children's children shall rejoice and feel grateful for the enterprise and forethought which prompted their ancestors of his generation.

In regard to the time for setting, spring is believed to be the most favorable, although good success has often resulted from autumn planting, thorough work being more decisive of good results than the choice of seasons. Securing good roots, proper preparation of the ground, and *thorough mulching* will insure the growth of a large proportion, whether set in spring or fall.

The marked success of one or two competitors who left the full tops on their trees has not convinced the Committee that such is the better way. We believe that a few years' growth will demonstrate the fact that close trimming and shortening will insure a more certain life, and a more even and well-proportioned top, than can be secured by the other system.

CALVIN ROOD, *Chairman.*

MANURES.

ESSEX.

[From the Report of the Committee.]

The details of the experiments made by the applicants for premium, as well as by Mr. Smith, are very interesting and valuable. The experiments were very similar in their nature, all of them being trials of the relative value of barn-yard-manure and Stockbridge fertilizer, and in two instances Darling's fertilizer. The past season, owing to the extreme drought, was very unfortunate for experiments with commercial fertilizers. The wonder is, that they were heard from at all. Notwithstanding this drawback, the experiments seem to give like results in each case, and are quite convincing. The whole subject of commercial fertilizers is of immense practical importance to farmers; and any reliable collection of facts showing their relative value as compared with barn-yard-manure, or with each other, is of great value, and will be eagerly sought. It costs something to try experiments; and the fault with them usually is, that the details are not kept with sufficient exactness. Probably, in a majority of cases, the farmer does not intend to make an experiment to be reported when he enters upon it; but after its completion, knowing it to be of value to himself, he thinks it will be to others, and he then narrates the details from recollection. The value of many of the statements concerning crops raised and offered for premium is materially lessened by the evident fact that they are estimates of cost made up after the crop is raised, rather than statements of details kept during the progress of its culture and growth. It is likely, that, in the item of labor, there is generally more time actually laid out in the cultivation of a crop than appears in the statement, for the reason that the cost is *estimated*, and this because the farmer does not, in the beginning, expect to report his experiment.

The great merit in the statements herewith submitted is, that the details of the experiments are given with unusual clearness and accuracy, and show what the crops actually did cost. Mr. Appleton kept his account of labor with a care we seldom see equalled in like cases. The three experiments *seem* to show that the Stockbridge fertilizer, and perhaps Darling's compound, are worth quite as much for a year as an equal value in animal manure. We know, that, when the latter is applied to the land, an important part remains for future crops. All, or nearly all, commercial fertilizers heretofore in general use have failed in this particular, and in most cases their constant and exclusive use has resulted in exhaustion of the land. Whether this is true of the Stockbridge and Darling compounds is a point that can only be settled by protracted trial, and this we conceive to be a point on which our farmers earnestly desire more light. We hope the gentlemen who have given us the results of their experiments this year, as well as others who have made similar trials, will continue their experiments, for the purpose of showing whether these newly-introduced fertilizers can be profitably used, and the fertility of the soil kept undiminished, without the use of other manures.

JOS. S. HOWE, *Chairman.*

[Statement of Francis H. Appleton.]

I send in this statement of my experience in raising Indian corn during the season of 1878, as it seems to me quite interesting, beyond being an accumulation of carefully made-up facts. As distances from barn, and other circumstances, vary in different fields, so must my figures vary from others of a similar kind.

I have taken much pains to keep an account in my diary of the time expended in the fields, from which my figures are taken. Both these crops were raised on worn-out sod-land upon which almost no grass could be cut in 1877. The one with stable-manure makes by far the worst showing, even after deducting the cost of one-half of the manure, as being in the land, and still good for next year's crops. In the case of the Stockbridge fertilizer crop it will be seen that

more fertilizer was applied than is generally recommended; and the question arises, whether any of it still remains in the land for the next crop, or whether the extra quantity has been washed down too deep in the land to be available manure, on account of its greater solubility than stable-manure. In my figures I have made no deduction for the value of any fertilizer that may remain in the land for next year's crop.

Had six bags only of the fertilizer been used (the general amount recommended by Bowker & Co., the makers), with the same result, which would theoretically have been possible, and I given credit for the extra three bags, the cost would have been nineteen cents and four-tenths for a bushel of corn on cob. The corn I used for seed was the eight-rowed variety.

In harrowing, cultivating, and hilling, some saving could be made by employing an intelligent boy to drive or ride the horses; and, in the second cultivating and the hilling, one careful man with a good horse would be all that is needed, the corn being high enough to perfectly mark the track for the horse. I also see in "The American Agriculturist" that three cents a bushel is the price to be paid for husking, which would decrease that charge one-half, where it could be done. My experience has been, that about twenty bushels per man in ten hours was the amount husked.

I should state that I used the Ross machine, which sowed my corn in drills, and dropped the fertilizer immediately after the kernels, in such a manner that they did not fall in contact with each other; and the former has in no way seemed to have been injured by the latter. The Ross hiller has also done me good service. By these machines I have been able to cultivate more land with my labor than I otherwise could.

Next year I intend to raise corn on a similar kind of land, with six bags of fertilizer to the acre, and shall hope to tell the result next year.

Three acres and 31,424 feet of Indian corn were on land which was run out in the previous year, excepting 21,329 feet, where potatoes were raised with manure in 1877, and which was in 1878 only enriched with fertilizer in drill: the remaining three acres and 10,095 feet were manured with stable-manure at the rate of six cords to one acre, with

the same fertilizer in drill. I have charged my labor at a dollar and a half per day of ten hours, and each horse at seventy-five cents per day; stable-manure at ten dollars per cord spread on the field. The manure was harrowed in by a Randall wheel-harrow. The time is given below in hours and minutes.

	Men.		Horses.			
	H.	M.	H.	M.		
Ploughing in autumn of 1877	41	50	43	40	$6	55
22½ cords stable-manure	–	–	–	–	225	00
Harrowing (Randall) April 19, lapping one-half	5	34	11	8	1	67
Harrowing (straight tools) May 17, lapping one-half	5	34	11	8	1	67
Sowing seed and fertilizer at same time (Ross machine), May 18	17	24	8	42	3	26
850 lbs. Bowker's hill and drill phosphate,	–	–	–	–	21	25
Seed	–	–	–	–	1	20
Sowing after crows, June 1	6	40	–	–	1	00
Two cultivatings with "scarifier" . .	20	27	10	13	4	86
One hilling (Ross machine) July 6 . .	13	20	6	40	2	50
Harvesting 3 loads tops, cut Sept. 20 .	105	–	16	–	16	95
Harvesting 7 loads corn and butts, Oct. 11,	57	–	32	–	10	95
Husking 441 bush., at 6 cents per bush. .	–	–	–	–	26	46
Interest and taxes	–	–	–	–	12	02

5,175 lbs. tops, 16,660 lbs. butts } 16,776 lbs. stover, at $6 per ton .	$50 33	$335 34
9¾ cords stable-manure unused	97 50	
		147 83
441 bush. corn on cob (or 1 bush. corn, costing 42½ cents) .		$187 51

One acre and 5,867 feet of Indian corn were on land which yielded a very light crop of Hungarian grass in 1877, without any manure or fertilizer. In 1878 it was manured with seven bags of Stockbridge corn fertilizer, sown broadcast, and harrowed in by a Randall wheel-harrow, and also two bags of same fertilizer in the drill. My charges are the same as I have already stated for the other field.

	Men.		Horses.		
	H.	M.	H.	M.	
Ploughing	7	34	15	8	$2 28
Nine bags Stockbridge corn fertilizer (two in drill)	–	–	–	–	45 00
Spreading fertilizer	1	42	–	–	26
Harrowing (Randall), lapping one-half .	1	42	3	24	32
Harrowing (straight tooth), lapping one-half	1	42	3	24	32
Sowing seed and fertilizer at the same time (Ross machine)	3	24	1	42	64
Seed	–	–	–	–	30
Two cultivatings with "scarifier" . .	6	48	3	24	1 28
One hilling (Ross machine)	3	24	1	42	64
Harvesting 1 load tops	39	–	6	–	6 30
Harvesting 6 loads corn and butts . .	12	–	8	–	2 40
Husking 184 bush., at 6 cents per bush. .	–	–	–	–	11 04
Interest and taxes	–	–	–	–	3 67

	$74 45
1,848 lbs. tops, 6,070 lbs. butts } 7,918 lbs. stover, at $6 per ton	23 75
184 bush. corn on cob (or 1 bush. corn, costing 27½ cents) .	$50 70

[Statement of Benjamin P. Ware.]

The land taken for my experiment with fertilizers this year is the same acre that was used for my experiment last year; this making the third year that it has been planted with corn, and only chemical fertilizers used. To this land I have added one-half an acre adjoining of the same quality of land. Last year this half-acre was planted with corn and pease on a fair dressing of barnyard-manure. The whole has been planted and cultivated by the Ross system of implements, which require no hand-labor except once weeding, and with that the field has been clean of weeds. By this system the cost of cultivating is very much reduced.

I divided the acre and one-half of land into four lots. On lot No. 1 (which contained the same land as lot No. 1 in my last year's experiment) I spread on broadcast, after ploughing, 658 pounds of Darling's animal fertilizer, which cost $13.36, and 70 pounds sulphate of potash, costing $1.75, making a total of $15.11.

Lot No. 2 contained half an acre, and is the same as lot No. 2 of last year's experiment. I spread on as above three

bags of Stockbridge fertilizer, prepared and sold by Bowker & Co., at a cost of fifteen dollars.

Lot No. 3, containing one-fourth of an acre, had no fertilizer whatever.

Lot No. 4, which also contained one-fourth of an acre, I manured with good quality cow-manure at the rate of seven cords per acre, valued at seven dollars per cord. It was spread on after ploughing, and harrowed in, as were the other fertilizers. The land was planted with corn May 20.

The cultivation was the same on the whole field, and the natural quality of the land as much alike as possible, being a gravelly subsoil, not subject to drought or wet; would be called good corn land. The corn was cut and stooked Sept. 15, and remained in stook until Nov. 11, when it was husked and weighed, being quite dry. Seventy-two pounds of ears yielded fifty-six pounds of shelled corn.

Lot No. 1 produced 2,193 pounds of ears (equal to $30\frac{45}{100}$ bushels of shelled corn) and 1,975 pounds of stover.

Lot No. 2 produced 2,210 pounds of ears, or $30\frac{69}{100}$ bushels shelled corn, and 2,000 pounds of stover.

Lot No. 3 produced 710 pounds of ears, or $9\frac{86}{100}$ bushels shelled corn, and 645 pounds of stover.

Lot No. 4 produced 985 pounds of ears, or $12\frac{98}{100}$ bushels shelled corn, and 1,136 pounds stover.

Cost of cultivation per acre is as follows: Ploughing, $1.75; harrowing, 75 cents; planting, $1.50; cultivating three times at 75 cents, $2.25; hand-weeding, $1; cutting and stooking, $4; husking, $3; carting in stover, $3; total, $17.25.

For convenience, I propose to reduce the results of the experiments to an acre each lot, and summarize them as follows: —

Lot No. 1, fertilized with Darling's animal fertilizer, produced $60\frac{9}{10}$ bushels shelled corn, at a cost of 52 cents per bushel; in 1877, on same lot and with same fertilizer, cost 39 cents per bushel.

Lot No. 2, fertilized with Stockbridge fertilizer, produced $61\frac{38}{100}$ bushels, at a cost of $50\frac{9}{10}$ cents per bushel; in 1877, on same lot, with same fertilizer, cost $62\frac{1}{2}$ cents per bushel.

Lot No. 3, with no fertilizer of any kind, produced $39\frac{1}{2}$ bushels, at a cost of $11\frac{1}{3}$ cents per bushel.

Lot No. 4, fertilized with cow-manure, produced 53 bushels, at a cost of 85 cents per bushel.

[Statement of Edmund Smith.]

The soil on which this crop was raised is a dark sand. It is in Newbury, near Plum Bush Bridge, on the Plum Island turnpike, and contains one acre. It is very little higher than the marsh adjoining, and is often covered by the tide. It has been in grass, but was pretty well run out. In 1877 it produced only three hundred pounds of hay. It was ploughed and harrowed May 28. It was furrowed, and the fertilizers applied the 29th, and one peck of corn planted the next day (the 30th). 400 pounds of Stockbridge corn fertilizer, costing $12.32, were applied to one half by measure, and 334 pounds of Darling's animal fertilizer, costing $7.52, to the other half. They were both applied by dropping a handful in the hill, covering with a hoe with about three inches of soil, dropping five kernels of corn in the hill, and covering with the hoe about three inches. The whole came up well, and grew rapidly. Cultivated both ways, and hoed the last week in June. Cultivated both ways July 23; hoed Aug. 2 and 3. The crop was cut Oct. 1, tied in bundles (six hills to a bundle), and put in stooks immediately,—about twelve bundles to a stook. Oct. 18, the corn was husked in the field, leaving the husks on the stover. The crop was weighed as taken from the field, the product being as follows: From one-half acre (Stockbridge), 2,000 pounds; from one-half acre (Darling's), 1,791 pounds; total, 3,791 pounds.

No other manure or fertilizer was applied to the crop. A high tide, when the corn was about six inches high, flowed in a low place, of about fifty hills, to the depth of three inches on the Stockbridge, reducing the crop on that part some. The Darling, being nearest the marsh, was raided upon by the rats, destroying, in my judgment, considerable more of the crop than Stockbridge was injured by the tide. The corn was the eight-rowed variety; and the percentage of unsound, or pig-corn, was very small. The stover (butts, husks, and top stalks) was sold and weighed from the field, for $18.10, weighing 5,870 pounds. The financial statement is as follows:—

Interest and tax on land		$3 00
Seed		25
Ploughing and harrowing		6 00
Furrowing, applying fertilizers, and planting . .		6 25
Cultivating and hoeing twice		8 95
Cutting and stooking		2 75
Husking and harvesting		4 75
		$31 95

CR.

From Stockbridge, 2,000 lbs. ears corn . . .		$20 00
Half of stover		9 05
		$29 05

DR.

One-half of expense, as above . . .	$15 97	
400 lbs. Stockbridge fertilizer . . .	12 32	
		28 29
Profits on Stockbridge		$ 76

CR.

From Darling's, 1,791 lbs. ears corn		$17 91
Half of stover		9 05
		$26 96

DR.

One-half expense, as above	$15 97	
334 lbs. Darling's fertilizer	7 52	
		23 49
Profits on Darling's		$3 47

PLOUGHING.

ESSEX.

[From the Report of the Committee.]

One of the rules of the society is, that "only double ox-teams shall have drivers." I think it well to adhere strictly to that rule in the future; but as the ploughmen all came expecting to plough with a driver, and, with one exception, were not prepared to plough at all without a driver, it did not seem best to enforce the rule. Then, again, these teams of three or more horses are practically double teams, and should be required to do the work of double teams; but the rules only required them to do the work of single teams, that is, to plough six inches deep. Though all the work was well done, there was none of it good, practical, every-day work, because it was not economical. It is not economy to use a double team and two men to do work that can be as well done with a single team and one man.

The team, driver, ploughman, and plough which took the first premium, each and all of them did as artistic work as I have ever seen. The team, driver, and ploughman which took the second prize, seemed to do as good work as the first; but the plough they used was not in condition to make as handsome work as the other. These were both four-horse teams. The team with three horses abreast worked well, and was well handled; but the ploughman failed to do artistic work in two respects. The first was, taking more land than his plough would at all times turn well over to its place, the sod doubling down, and leaving cavities which it would take considerable harrowing to fill up: the other respect — of no practical importance, except the very important one of good looks — was, that he did not straighten the crooks made when cutting out the lands, but continued to plough as crooked as the copy set for him to work by.

Perhaps he thought it best to imitate the copy as exactly as possible: at any rate, I can thank him for doing it; for it gives me an opportunity to say that ploughing out the centres of lands after they have been marked out looks to me like apprentices' work. A master workman can cut out his own lands.

I know of no direction in which a little more knowledge would be of so much practical benefit to the farmers of Essex County as in the art of economical ploughing. There are very few farmers in the county who can take a pair of spirited horses, drive the team themselves, and cut out lands; or furrow out with one or two horses; or cultivate their crops as well without a driver as with one: and yet there are very few farmers in the county, who, if they had a little more practical knowledge of the art of holding and driving at the same time, would not be perfectly independent of drivers for any of their ploughing or cultivating; for they would soon learn what some have already learned, and that is, that they can drive better when holding the plough or cultivator than any one can drive for them.

I wish to ask if it is not time for our society to begin the work of educating the farmers of the county, so that they can cut out their lands, and do all their ploughing and cultivating, without a driver.

I wish to ask if it would not be well for the society to offer premiums for the best single furrow ploughed in sod-lands, the team and plough to be furnished by the Committee; all competitors to use the same team and plough; and also, if it would not be well to offer premiums for the best three or five furrows with a single horse, as in marking out for potatoes. This work could be done after the ploughing-match, if the land was well harrowed.

ANSEL W. PUTNAM, *Chairman.*

FRUITS.

ESSEX.

[From the Report of the Committee on Pears.]

The pear we believe to be the favorite fruit of to-day; and we recommend to any one setting out trees for profit, to devote as much land, at least, to the raising of pears as he does to his apple-orchard; for we consider it, when not grown in too many varieties, and only of those varieties that are adapted to the soil, to be the most profitable crop that can be raised.

Your Committee noticed in the exhibition hall, that, while the fruit of some exhibiters was very fine, the same varieties by others were greatly inferior; and, as each is likely to show his best fruit, others in the county have, without doubt, the same varieties entirely unfit for exhibition.

To enable your Committee to ascertain the practical experience of the different fruit-growers in raising their pears, that the information might be reported to the society, the following questions were sent to each exhibiter, as also, with slight alteration, to members of the Committee, and a few of the other fruit-growers who made no exhibit this year of their pears; viz., 1. What different varieties of pears did you exhibit at the county fair at Lawrence? Indicate on what kind of tree raised, by marking S for standard, or D for dwarf, over each variety. 2. What kind of soil? 3. Subsoil? 4. How often is soil enriched? 5. What with? 6. How much do you prune, and when? 7. Have your trees been troubled with the blight or insects? 8. If so, what remedy have you tried? With what success? 9. What are the most profitable trees to set out, — standards, or dwarfs? 10. Why? 11. When do you pick your different varieties of pears? 12. How long afterwards are they ripe for eating? 13. How do you keep them best and longest? 14. What

ten varieties are recommended by you for profit, and why? 15. Give such other information as you think may be of interest to others.

The above fifteen questions were sent in such a form that they could be readily answered on the same sheet. Had it not been that the varieties exhibited were in most cases (as should always be in all) entered upon the entry-book, it would have been impossible to ascertain them, except from each exhibiter afterwards. Even if a few of the questions had been answered by all, it would have shown that each was willing to contribute even a little to the stock of general information which our society is organized to promote, and which it should be considered the duty of every committee to obtain, regarding the special object of which it is made the judge, and report it. The mere looking at an object in the pens of the fair-grounds or on the tables of the hall is only a gratification to the eye. To know how the objects have reached such perfection as to gratify the eye imparts knowledge, that, too, of the very best kind; it being the practical experience of exhibiters from all parts of the county, whose information of their manner of feeding, cultivating, or making, to arrive at the result exhibited, is the most valuable, and most desired by our society, and which each exhibiter should feel it a pleasure, as well as a duty, to impart unsolicited, to be made use of by the Committee in their report. If the good points of such information are adopted by others, it will not injure him: its only result would be to raise the standard of excellence.

Some of the replies to the questions asked are appended as part of this report, and will be read with interest and instruction (especially that of Mr. John O'Brien of Bradford); for much valuable information can be derived from them.

The almost unanimous reply as to standard or dwarf trees for profit is in favor of standards, on account of their larger and thriftier growth, longer life, greater productiveness, and requiring less care, being more hardy than the dwarf. The Duchesse d'Angoulême is the exceptional pear: that grows better on dwarf stock. There are others that produce better fruit on dwarf. Dwarfs of some varieties, well cared for, are good for ten or twelve years. They fruit quickly, and enable the amateur to have a great variety in small space.

The soil for pear-trees should not be too rich; if it is, they will grow too rank, be more liable to blight, and less likely to form strong fruit-buds. You cannot starve them, however, any more than you can any crop, and expect it to succeed. Keep them thrifty. We would urge upon all who have not already tried it the use of a pen or hogsheads, into which can be put the sweepings of the house, chamber-slops, meat-bones, old shoes, leaves, and other refuse of the house and garden, which, when scattered around the place, make the yard untidy and unwholesome, and which would, when accumulated in a mass, and deodorized with fresh earth thrown upon it from time to time, be a surprise in the amount and richness of the compost that would be so beneficial for the fruit-trees. The soap-suds of the washing-day of an average-sized family emptied around the grape-vines and fruit-trees are equal to a wheelbarrow-load of manure.

Ashes from coal or wood, from the latter being best, are excellent for fruit-trees. Coal-ashes put around trees — say ten inches to one foot high at the trunk, extending out two or three feet — are recommended as a good protection to the roots, like mulching, giving the trees a better start in the spring. Top-dressing in the fall is by far the best method of manuring fruit-trees whenever they are not making a thrifty growth. We think that trees when so treated are less likely to blight than when manure is ploughed or dug in. We should not advise manuring heavily at any one time, but give them a slight top-dressing every fall with well-rotted manure (as straw or coarse manure harbors mice), and it will be found more favorable to thriftiness, productiveness, and exemption from disease. One or two shovelfuls of fresh cow-manure applied to the trunk of the tree we have tried with success against mice in winter.

Change of soil by transplanting accomplishes astonishing results sometimes. We have known a tree, barren for years, to be taken up and transplanted a hundred feet, to soil dryer and more gravelly, and produce fruit abundantly afterwards. A Bartlett pear-tree considered worthless, growing in the border of a cold-grapery, in rich, deep garden-soil, on which the fruit (not much larger than an English walnut) was black, and badly cracked, was given to our chairman by Dr. Davidson, in Gloucester, to try the effect of change of

soil. It was taken two miles away, and planted in a strong, clayey, virgin soil just broken up. The result was, that a new, vigorous life was imparted to the tree; and this season it produced from two to three bushels of as fine pears as any one need desire. The first year that it fruited after removal, not a pear was cracked; all were of fair size, but a large number were gnarly. They have improved in size and quality every year since. The tree has grown to thrice its original size, and is very prolific every year.

The right kind of soil for the right kind of tree will produce superior fruit on that tree, wherever located, although protection from bleak winds adds greatly to the effect of the soil. We think the soil in and about Lawrence is suitable for a number of varieties.

George E. Taylor of that city, who had a plate of fine Beurre Hardy pears in the fair, says of his fruit, "I sold my Bartletts before the fair, fifty of which filled a half-bushel. I had some very nice Duchesse, many weighing sixteen ounces apiece. The trees are all standards, growing between houses, on low, sandy soil." Mrs. Benjamin McAllister of same city, who had the finest Bartlett pears, and was awarded the premium, states they were grown on a standard tree; that she "simply let them grow in the garden until fall, and then picked them."

The remarkable size and quality of Dr. Kenney's fruit, raised in the same city, attracted much attention. Flemish Beauties — that grow so badly cracked in most parts of the county, and are considered almost worthless — were there of great size and very fair. He states that they are of the finest quality, and the richest pear he has, in a variety of ten or twelve kinds, all of which produce the same good quality, according to their kind, as those exhibited.

His manner of setting out and treatment of his trees afterwards probably had a considerable effect upon the result; for, when he set out the trees (about sixteen years ago), he had holes dug about four feet in diameter, and two feet and a half deep; then filled in about one foot of compost, bones, old shoes, lime, and old scraps of iron; then covered that with about six inches of soil; then set his trees, and "filled in with rich soil, which, in Lawrence and all about there, is the common soil." In addition to enriching the soil around the

trees by spreading on sink-deposits every two or three years, he also spreads on the ground, over the roots, not very near the body, about a pint of iron turnings or filings, with half a pint of salt, around each tree, every four or five years. His trees are protected from all winds, except from the east, and he prunes off half the previous year's growth in the spring.

We think that iron is of great benefit to pear-trees, as well as other kinds of fruit-trees, our chairman having used the sweepings of a blacksmith's shop where horses are shod (containing old nails, bits of iron, hoof-chips, &c.) around apple and pear trees, with an occasional dressing from the sink-drain, to much advantage as regards the size and fairness of the fruit; he has readily disposed of what Clapp's Favorite and Bartlett pears he had to sell at from two dollars and a quarter to two dollars and a half per bushel, and several bushels of Duchesse at three dollars; this — in contrast with apples in such abundance that twenty to forty cents per bushel were the selling-prices, with two hundred bushels for cider — leaves a large margin in favor of pear-culture for the area occupied, although it detracts nothing from the value of the dressing used for both kinds of trees.

Opinion differs in regard to pruning: some advocate much; others, little or none: some at certain times of year, and others at any time. We think, however, that the majority decide upon the spring as the best time for it, though we believe that any time between fall and spring will answer as well. Whenever done, it should not be done harshly. It is better, when the growth requires it, to prune moderately every year sufficient to keep the tree stocky, and able to bear up under the weight of its fruit, and open enough to obtain the benefit of sun and air to mature it. It is also of great benefit to trees and fruit to thin out the fruit, especially on Bartlett, Louise Bonne, Vicar, and Seckel pear-trees, as those varieties are apt to overbear.

The blight, now so well known in pear-culture, is cured best by the free use of saw and knife, cutting away the part affected until sound wood is reached, covering large wounds on the tree with a dressing of clay and cow-manure, or a coating of linseed-oil, both of which have been tried with good success by your Committee and others. Our chairman

had a Bartlett pear-tree about four years old, blighted on the westerly side of its trunk, commencing about nine inches from the ground, extending upwards over eighteen inches, and extending around about one-third of the circumference. All of the affected part was cut out, and a coat of linseed-oil applied, resulting in having the tree to-day as good as any in growth and fruit; and, although the growth of the bark has nearly covered the wound, the symmetry of the tree is not marred. In most cases, however, the disease and its remedy are a serious drawback to the welfare of the tree. The slug and most insects, if they are taken in season, on almost all kinds of trees, can be got rid of by a dusting with wood-ashes or air-slacked lime when the tree is wet. (Peach-trees with the "curled leaf" can be cured by a dusting once or twice with wood-ashes when the tree is wet.) Mr. William McRae of Lawrence states that his pear-trees were troubled with "rose-bugs," which were destroyed by burning tar under the trees.

We would advise our farmers and fruit-growers intending to set out pear-trees for profit to ascertain carefully what varieties are the most profitable in their immediate vicinity, on soil similar to their own, and not try, except for experiment, other varieties, until tested by themselves or their neighbors, as the same variety that does well in one place is unprofitable in another; and, although a certain number of varieties are recommended by our society for general culture, some of them do much better in that part where the soil is best adapted for them, which can only be ascertained by actual test. And if this is done thoroughly throughout the county, and the mode of culture of the trees, with the result attained (including the number and variety of trees planted, and the varieties succeeding the best) communicated to our society, it would enable it not only to recommend a larger number of varieties, but also to state the parts of the county best adapted to the successful culture of each variety.

All unite in stating the best time for picking fruit to be when the stem separates readily from the twig upon lifting the fruit. Change of color and the premature dropping of the fruit, forced ripe as it is commonly called, is another good indication. All kinds of pears should be picked off before ripening: many choice varieties are almost worthless,

if allowed to ripen on the trees. Mr. Barry, when editor of "The Horticulturist," aptly stated, "The process of ripening on the tree, which is the natural one, seems to act upon the fruit for the benefit of the seed, as it tends to the formation of woody fibre and farina. When the fruit is removed from the tree at the very commencement of ripening, and placed in a still atmosphere, the natural process seems to be counteracted; and sugar and juice are elaborated, instead of fibre and farina. Thus pears which become mealy, and rot at the core, when left on the tree to ripen, become juicy, melting, and delicious when ripened in the house." Winter-pears should not be picked until absolute danger from freezing approaches: they will then ripen up firm, with high color and finer flavor. All pears should be picked off, with the stem on, carefully, and handled as little as possible, and very carefully afterwards, as every scratch will turn dark on mellow fruit, and every bruise will rot it. The practice of some, of rubbing fruit to make it shine, injures the keeping-qualities of the fruit, destroys its natural look; and any exhibition committee should give the natural fruit the preference. Fruit with an unnatural shine on the whole in the plate more properly belongs to the huckster's stand than to the tables of an agricultural society's exhibition.

To keep pears longest and best, they should be kept in a dark, cool, dry place, with temperature, if possible, at about forty degrees, taking them to a warm, moderately moist place to ripen and soften them: an even temperature of seventy degrees is best. If laid between papers in summer, and blankets in winter, to ripen, they will come out with better flavor and color, ripening quicker, and without wilting. Fruit loses flavor if ripened in a place too cool.

The two large platefuls of Clapp's Favorite pears and Williams Favorite apples, exhibited by our chairman, attracted attention, not so much for being handsome specimens of their kind, but for being "past their season," having been kept by wrapping each one in paper, and packing them in a keg heavily lined with newspapers. The keg was then headed up, and placed in a large ice-house near his premises until the day before the fair. A neighbor of his wraps apples separately in papers, packs them in paper-lined barrels, and then fills the barrels with dry sand, sending them to hot

climates with success, as regards their keeping. A writer in "The London Garden" says that "he keeps fruit in this way all the year round. He has kept French crab-apples two years. The Catillac pear has remained sound twelve months. The fruit must be sound "when stored, and the sand must be quite dry."

"The chief advantages of packing in sand are the exclusion of air-currents, the preservation from changes of temperature, and the absorption of moisture, which favors decay. Much will depend on the apartment in which the experiment is tried; a dry, cool one being best."

The varieties recommended in the replies to the inquiry, "What ten varieties are recommended by you for profit? and why?" are given below, in the order in which they received the highest number. For their special claims in rank you are referred to the replies appended, extracts from which, for the first ten varieties, are given here; viz.: —

1. Bartlett: bears early and abundantly; quality admirable; is a great favorite; always sells; ripens in September. 2. Sheldon: grows well; bears well, and sells at highest prices; ripens in October. 3. Louise Bonne de Jersey: good grower; very productive; finds a ready market; ripens in September. 4. Beurre d'Anjou: excellent; productive and profitable; excellent keeper; ripens from November to March. 5. Duchesse d'Angoulême: of the highest quality and most popular; ripens in November and December. 6. Seckel: of the highest flavor known among pears; productive, bringing a good price; ripens in October. 7. Beurre Clairgeau: early; abundant bearer; large and handsome; ready market at highest prices; ripens November to January. 8. Beurre Bosc: excellent and high-flavored; much in demand; ripens in October. 9. Lawrence: free bearer of excellent winter pears; sells high; ripens November and December. 10. Vicar of Winkfield: great productiveness; ripens when others are nearly gone; finds a ready sale at good prices; ripens December to March. 11. Rostiezer. 12. Belle Lucrative. 13. Onondaga. 14. Clapp's Favorite. 15. Winter Nelis. 16. Howell. 17. Urbaniste. 18. Buffum. 19. Beurre Giffard. 20. Marie Louise. 21. Paradise d'Automne. 22. Glout Morceau. 23. Dearborn's Seedling. 24. Bloodgood. 25. Kingsessing. 26. Tyson.

DAVID W. LOW, *Chairman.*

SPECIAL RULES TO GOVERN FRUIT EXHIBITS, ADOPTED BY THE SOCIETY, NOV. 13, 1878.

All fruit must be entered in the name of the producer; and each exhibiter must certify to the same on lists of the varieties, to be filed when entry is made, or on the entry-book. (Committees are not authorized to make awards to those who do not comply with this rule.)

Tables will be labelled in a conspicuous manner by the hall committee, previous to the entry of exhibiters, with the names of fruit, or collections of fruit, for which premiums are offered; all others to be classed and labelled as miscellaneous.

Exhibiters must place their several varieties where indicated by such labels, or be considered by the committees as not competing for premiums.

Collections where premiums are offered for a number of varieties must be entered and placed by themselves, on the tables assigned for collections of that class of fruit.

Specimens of any variety in such collections are not to compete with specimens of same variety placed elsewhere.

No collection can be awarded more than one premium.

Exhibiters of collections are not prevented from exhibiting additional specimens of any variety with, and for competition with, others of that variety.

Plates of twenty-four specimens of fruit, when premiums are offered therefor, must be entered and placed by the exhibiter on the table assigned for that class of fruit-exhibit.

To entitle exhibiters to receive the premiums and gratuities awarded, they are required to give information to the committees (when requested) in regard to the culture of their fruit.

[Reply of Baldwin Coolidge of Lawrence.]

My place is quite small, — a half-acre only. The Seckel is ordinary nursery stock; the Duchesse is imported. My soil is a clayey loam, with a hard clay gravel-packed subsoil. The soil is enriched once in two or three years with night-soil, deposited in a series of holes dug around the trees, — three or four holes to each tree, and from four to six feet from tree to nearest edge of hole.

I prune my trees a good deal, almost mutilate them, keeping them stocky and short, except when growing them for wood, and not fruiting. I prune usually in the spring, but sometimes in the fall. Think fall the best, on account of snows and storms having less of the tree to act on: the tree then knows just what to work on in the spring.

I have lost two trees by blight: the trees dry up and die. I keep red spiders off with soap or potash, and put bar-soap in the crotches of the trees, and let it gradually waste away all summer. I found some left when picking this fall.

In regard to the most profitable pear-trees to set out, that depends upon kinds, location, whether to eat or sell, &c. I have both dwarf and standard Duchesse, and the standard is not to be compared with the dwarf; but the dwarf is from France, the standard common. I pick my pears when the stem will break off in the right place with a moderate degree of force, such as Seckel, Bartlett, Louise Bonne de Jersey, Clapp's Favorite, Belle Lucrative, Rostiezer, and Tyson. The Duchesse I gather the first week in October, and they ripen from October to Christmas. I keep my pears cold, dark, and dry.

I get iron-dust from machine-shops, and dig in around the trees, as one would dig in guano; rub soap all over the trunk, and keep the tree propped up. I think I lost one tree by its leaning over with fruit three years in succession (a Passé Colmar). It seemed to tear the small roots off.

[Reply of M. B. Kenney, M.D., of Lawrence.]

I exhibited pears raised on a mixed sandy loam, enriched once in two or three years with sink-deposits spread on the surface. I prune off about half the previous year's growth in the spring.

My Vicars, Rostiezers, and Buffums have suffered badly with the blight. My other varieties have not been touched by it. A radical cutting is all that I have tried, and have saved some of them, although much injured of course.

The most profitable trees to set out, I think, are standards. We don't get the fruit so quickly; but they have a longer life, and are just as sure to bear a crop as the dwarf.

I pick my pears as soon as they get their growth, and begin to turn yellow. They ripen in from two to four weeks. I have never tried how to keep them best and longest.

I cannot recommend varieties for profit. I do not raise them for market. I go more for quality than quantity. I am aware that the Flemish Beauty has the reputation of cracking badly, but mine have seldom cracked. They are of the finest quality, and the richest pear that I have in a variety of ten or twelve kinds.

The Committee, wishing to avail themselves of the experience of the Hon. Marshall P. Wilder, the veteran pear-grower of America, applied to him, and received the following list: —

[Reply of Hon. Marshall P. Wilder.]

The following list of pears comprises an excellent collection: they are all healthy trees, and the fruit is good, either for the table or market, in its season, — Clapp's Favorite, Bartlett, Doyenné Boussock, Paradise d'Automne, Merriam, Sheldon, Beurre Bosc, Lawrence, Beurre d'Anjou, Vicar of Winkfield (for baking: fine specimens are also good for dessert).

Clapp's Favorite. The best early large pear; should be gathered by 20th of August.

Doyenné Boussock. Splendid healthy tree, very productive, and salable in market. Half the crop should be gathered by the 25th of August, and ripened in the house, the remainder when the fruit comes to size; thus the tree is kept in bearing every year.

Merriam. One of the most profitable for market, on account of its fine golden russet-color, which it assumes after it is picked.

Beurre d'Anjou. The best and most profitable very late fall and winter variety, covering the months of November and December, and with care may be kept to February; popular throughout the United States; the most valuable pear that I have introduced in forty years.

[Reply of H. G. Herrick of Lawrence.]

I exhibited the following varieties of pears; viz., Swan's Orange or Onondaga, Louise Bonne de Jersey, and Beurre Bosc, all grown on standard trees in garden loam, with clayey gravel subsoil, enriched every year with old manure, with some mulching of coal-ashes dug in.

I prune only enough to keep the trees in symmetrical shape in spring. I keep the branches open enough for the sun to shine through them.

My trees have been troubled with blight heretofore, — not much this year. For a remedy I have tried knife and saw, — heroic treatment. If done early enough, the tree has been saved; if not, then not. I have had no experience with dwarf trees. I pick my early fall pears when they have attained full growth, and before they change color. They ripen in from one to three weeks, keeping longest and best in a dark, dry, cool place, with plenty of air. I have had no experience in marketing pears. In enriching the soil for my trees I dig in the manure around the trees every year, — usually in the fall, — and put a pile of coal-ashes about the tree, say ten inches to a foot high at the trunk, running back two or three feet. It seems to be a protection to the roots, like mulching, giving the trees a better start in the spring.

[Reply of E. W. Greene of North Andover.]

I exhibited two kinds of pears, viz., Bartlett and Beurre Bosc, both varieties raised on standard trees grown in a heavy loam, with a hard-pan subsoil enriched yearly with light dressing of stable-manure. I prune very little in spring. I have been troubled with both blight and insects, to some extent; have tried no remedy. I pick my pears, — Rostiezers when ripe, most of the others when the stem separates from the wood by lifting. They ripen in from one to four weeks, the earlier varieties quickest. I keep and ripen them best in a cool place, free from air.

[Reply of Theron Johnson of North Andover.]

I have a dark, heavy soil, under-drained, subsoil clayey, enriched last year a little, but not before for five or six years, with barnyard-manure, about two shovelfuls to each tree, put on in the fall: this spring it was spread over the orchard.

I have not pruned, except to cut away dead wood. I have lost a number of trees by blight, but have tried no remedy.

I think standards the most profitable on our soil, but cannot say why they are best, except that it is very difficult to make dwarfs grow here; on lighter soils I think dwarfs generally do better.

In picking and ripening pears my usual rule is to let all kinds hang, till, by lifting the pear, it readily parts from the tree. Vicars and late pears I let hang as long as safe. Different varieties vary in ripening from one to two weeks after picking. I find, that, by placing them as soon as picked on a shelf in a cool cellar, they have kept better than any other way.

[Reply of John O'Brien of Bradford.]

My soil is a sort of dark-brown loam, neither light nor heavy, from twelve to fifteen inches deep, with a subsoil of very fine yellow, having as near the color of ground ginger as any thing I can imagine, and I am satisfied that it is the soil for the apple, pear, and grape. It is enriched every fall, as my pear-orchard is my kitchen-garden. I plough under a very liberal supply of barnyard-manure, excrement of horses and cows, which is the best fertilizer that I know of for all kinds of plants, when properly applied to the soil. Wood-ashes are excellent, but they are too scarce and too costly for profit.

I have been equally successful with pruning done soon after the fall of the leaf and that done the 20th of March on both pears and apples; though I think the proper time to prune is during the dormant period, when there is no upward flow of sap. I believe pruning systematically done regulates the growth and welfare of the tree, and has a great tendency to induce the maturity of fruit-spurs, thereby producing fruit earlier and of better quality, to say nothing of the uniformity

of the tree. I am opposed to sawing off large limbs, as by it the tree receives a severe shock, which must necessarily retard its growth; but, if it must be done, the wound should be immediately covered with a mixture of cow-manure and clay. This helps to heal the wound, and is a protection from the weather.

To do away with this butchering entirely, I permit no surplus wood to grow, or, in other words, pinch off all surplus young shoots when about five inches long, heading down especially thrifty trees by cutting off two-thirds of the last year's growth with a sharp knife, and make a smooth cut, slanting upwards on a level with the point of the bud. In soft-wooded, pithy trees, half an inch ought to be left above the bud. The position of the bud cut to is also of much importance in changing the form of the tree; that is, if you wish a shoot to grow upright, prune to a bud on the inside of shoot; and, to spread, prune to a bud on the outside, for, if you cut every year to a bud on the same side, in two or three seasons it will show an inclination to that side, — a great injury to the symmetry of the tree. It is essential to head down once a year in order that every limb should grow strong enough to stand up under its burden when it fruits.

Regarding blight: I had a very thrifty standard Seckel tree in my orchard, which had about six inches of every branch on it blighted in the winter of 1871–72, and, singular to relate, it was not the last growth, but the growth of the year previous, that blighted, while the growth above it, and all below it, remained sound: you could see at a distance a black line about six inches long. On discovering this, early in spring I cut off with my shears every branch six inches below the blighted part, so as to stop its spreading any farther; and now I am glad to say that the tree is thrifty and healthy, and last year I exhibited at the fair at Lawrence a dozen of its pears that I thought would bring the first premium.

The most profitable trees to set out, for permanency and profit, are standards, because they grow larger, are more thrifty, live longer, and produce more fruit, the Duchesse d'Angoulême alone excepted, which thrives best on quince stock. The dwarf, as a rule, comes to bearing soon after planting, and bearing a few specimens every year keeps it in

a stunted and sickly state, so that, when a dozen years old, it is next to worthless; whereas the standard, being, as I may say, a natural tree, grows wood for future use, which is necessary before it ought to bear fruit for profit. We must not think that they are backward in bearing either, for we find our best varieties, six years from planting (soon enough), well spurred for fruiting, with sufficient dimensions to bear two bushels of pears; and with me such varieties as the Bartlett, Belle Lucrative, and Beurre Clairgeau, have produced abundantly the fourth year from planting. But I would rather my trees grow wood than fruit until they obtain sufficient size to hold up the fruit.

In picking and ripening pears, a good rule to follow is to pick, when, on gently lifting the fruit, the stem will separate from the limb: the best place to keep them, is a dark, cool, dry room, with a good circulation of air. I pick Bartletts, Sept. 1, they were ripe the 15th; Beurre Clairgeau, Oct. 1, ripe Nov. 10; Beurre Bosc, Oct. 1, ripe the 20th; Duchesse d'Angoulême, Oct. 10, ripe Nov. 10; Louise Bonne de Jersey, Sept. 20, ripe Oct. 5; Sheldon, Sept. 25, ripe Oct. 15; Seckel, Sept. 25, ripe Oct. 10; Lawrence, Oct. 10, ripe from Dec. 1 to Jan. 1; Beurre d'Anjou, Oct. 10, ripe Dec. 1; Vicar of Winkfield, Oct. 10, or as long as you can safely leave them to grow; they will keep in a good dry cellar till March, and are fit to eat from December to that time. Treat Winter Nelis the same as the Vicar. Another good pear, that I raise myself, I must not pass over; that is the Belle Lucrative. It is very productive; but, though a good pear, it is not very salable in the market. You must bear in mind that the seasons and circumstances have a great deal to do with keeping fruit.

For the ten varieties for profit, I give you a list of the best varieties and most profitable in the whole catalogue of the pear family. There are other varieties worth raising, but without much profit.

Bartlett. Bears early and abundantly; a great favorite; always sells. Sold this year at from two dollars to two dollars and a half per bushel.

Seckel. The highest flavored pear known; productive, and brings good price. Sold at from two dollars to two dollars and a half per bushel.

Sheldon. A fine grower and a good bearer; sells for the highest price. Sold at from two dollars and a half to three dollars per bushel.

Beurre Clairgeau. An early, abundant bearer; a magnificent market-fruit, large and handsome. Sold mine this year for three dollars per bushel.

Beurre Bosc. Excellent and high flavored; ranks high with fruit-dealers. Sold this year for three dollars per bushel.

Beurre d'Anjou. A fine pear; productive and profitable; no orchard is complete without it. Sold at from two dollars and a half to three dollars per bushel.

Duchesse d'Angoulême. One of the best and most popular in the list. Sold at from two dollars and half to three dollars per bushel.

Louise Bonne de Jersey. Very productive; good grower; finds a ready market. Sold at from two dollars to two dollars and a half per bushel.

Lawrence. An excellent bearer; one of the very best winter pears. Sells high, selling at from two dollars and a half to three dollars per bushel.

Vicar of Winkfield. On account of its great productiveness, ripening when most all others are gone, it finds a ready sale at from two dollars to three dollars per bushel.

In answering your questions I give you that which I have learned from practical experience, though not on a very large scale. I have a little orchard of seventy-five trees, all standards save some Duchesse. I grew the ten varieties I named in the list for profit. I can rely on them even when apples fail; and when apples are a drug, as is the case this year, they sell for a fair price, and the demand for the fruit is constantly increasing year after year. The pear succeeds best on a rather heavy loam: the soil should be kept clean and mellow, with a broadcast manuring and cultivation, which they require during the growing season. If a hill of corn requires cultivation to accomplish its mission well, how much more so does a bearing tree!

[Reply of John Preston of Georgetown.]

My soil is a very dark rich loam a foot or more in depth, with subsoil of a yellowish rich loam a foot or more in depth, resting on a stratum of extremely fine white sand, or sand and clay intermixed, the sand very largely predominating. This stratum of sand is so compact as to form a hard pan.

I enrich the soil around my trees yearly, usually in the spring of the year, with Stockbridge's Fertilizer for Fruit-Trees and Bradley's Superphosphate of Lime. I prune only enough to give the trees perfect form. I usually cut back the leaders about the last part of August, or late enough in the season to prevent a succulent growth. By this method of pruning, the sap is impeded in its circulation, and the result is a larger growth of fruit spurs and buds.

My trees have been troubled with the blight and insects, to some extent. If some part of the tree is diseased, I immediately remove that part: if the tree is diseased generally, I immediately cut it down, and commit it to the flames.

Some three or four years since, my pear-trees were infested with pear-slugs; but by several applications of air-slaked lime to the foliage of the trees, when moist with dew or rain, I destroyed most of them. No other insect has done me much damage.

For the most profitable trees to set out, I should say standards on most soils, and dwarfs on some soils; because standards will grow and thrive on most soils in Essex County. Dwarfs require a very deep and rich soil, and high cultivation, to make them thrive well, with more attention on the part of the cultivator.

As regards picking, ripening, and keeping, I usually gather early summer and early fall varieties from one to two weeks before maturity; late fall and winter varieties, the last of September or first of October, the early kinds ripening from one to five weeks after picking, according to variety. For the late fall and winter varieties I can give no definite time. I keep them in small, tight boxes placed in the coolest part of my room or cellar.

[Reply of John W. Marshall of Rockport.]

I exhibited Sheldon pears and Beurre d'Anjou, grown on standard trees, in what was a swamp, having been filled in with a foot of loamy gravel: the soil under the swamp foundation is clay. The soil is enriched every year with barn-manure and compost, a good liberal dressing. I have a pen in which house-offal, leaves, &c., are put, with an occasional throwing on of soil to prevent its becoming offensive, making, with my small family and garden, about a cord and a half of very rich compost.

I prune any time. When I see a limb growing out of shape, I clip it, without regard to the season of the year. My trees have been troubled with fire-blight: several trees have been killed, and others injured. I always have noticed that the fastest-growing trees are the ones most affected. The blight was noticed in mid-summer by the limbs and leaves turning black, just as if fire had struck them. I cut off the parts affected.

I believe that standards are generally the most profitable pear-trees to set out, with exception of the Duchesse, Louise Bonne, Vicar, and perhaps some others, which do better, I think, on dwarf trees, bearing better fruit. Standards with room enough will last longer, and be the most profitable for most varieties.

I recommend for profit the Bartlett, Louise Bonne de Jersey, Sheldon, Beurre d'Anjou, Duchesse d'Angoulême, Belle Lucrative, Vicar of Winkfield, and Lawrence, because they are well known in the market.

[Reply of Peter Waite of Danvers.]

I think a small amount of good fruit is better than much poor. Spring and summer I like best for light pruning, and the fall for large limbs. Some kinds need much pruning, while others need but little. It needs good judgment and practical experience, and should be attended to.

My trees have been troubled considerably with the blight. My remedy for it is, amputate immediately, as you would your leg or arm if they were affected with gangrene; and

you must be careful to get below all the affected part, for the poison runs down in the sap, and destroys as far as it goes. My success, when the work is done in season, is complete; but neglect is fatal.

For the most profitable pear-trees to set out, standards are the only kind I would set, unless dwarfs are set deep enough to root from the pear stock. The dwarf makes only a small tree, the roots not being sufficient to support it; then it is short-lived, and affords but little fruit.

When to pick pears is altogether governed by circumstances; but most pears should not ripen on the trees. By giving attention, with very little experience a mere novice might know when to pick his pears, which will ripen, some in three days, others weeks. I keep them best and longest in a dark, cool place. I find for late pears no better place than a cool cellar. Light and heat ripen them up quickly. Some seasons some kinds will not ripen up well. This is peculiar to the Vicar, and, in consequence, some think it not worth raising; but it is an excellent pear, and often will keep till spring, but it must be grown large.

Most people who have a foot of land must have a pear-tree, and those who have more land must have more trees in proportion: hence most have two trees where they ought to have but one. I know of some fine pear-orchards that have double the trees they should have on the ground; and this is a great loss in the outset, while there are other disadvantages in so much crowding.

[Reply of Benjamin P. Ware of Marblehead.]

My soil is a strong kind, not subject to drought, with a subsoil of gravelly loam, some clay. The soil is enriched with a compost of barn-manure and sea-kelp for five or six years in succession, then rest in grass for three or four years. My trees are pruned a little annually in the spring; avoid cutting large limbs, by cutting out, while small, such as will interfere, when grown, with others.

My trees have been troubled by fire-blight, so called, and more, I think, when manured the most; also somewhat by slugs in August. I know of no remedy for the blight.

When attacked by it, the tree usually dies in about three years. I have tried cutting off the diseased branches, but with little success. The slugs may be destroyed by dust of any kind.

I think standards the most profitable to set out for orchard culture, and dwarfs for amateurs or small gardens. Standards will produce larger results, and are more easily cultivated.

Summer and fall pears should be picked when they begin to drop, which is before they are ripe; winter pears, about the middle of October. Summer pears ripen in about a week, and fall pears in about two weeks, after picking.

Pears should be picked carefully into boxes or barrels, and placed in a cool, dry cellar, not allowing them to wilt by being too dry, and as near thirty-five or forty degrees as possible.

For profit, only well-known standard varieties should be grown. The Beurre Giffard is good size and quality for an early variety; bears well. Clapp's Favorite comes next in ripening; is very showy, good quality, and productive. Bartlett is perhaps the most profitable of any; comes in bearing young; very productive and popular; large and showy, quality that almost every one admires. Seckel, best quality; prolific; sells well; very small unless thoroughly thinned out. Beurre Bosc is large and beautiful; sells well, but comes late into bearing; does well on gravelly subsoil. Sheldon, very beautiful and fine; sells well. Beurre Clairgeau is a great bearer, commences young; very large and beautiful, but not of first quality; sells well. Duchesse d'Angoulême is largest size, fair quality, good bearer; sells well; does best on dwarf stocks. Beurre d'Anjou is probably the best of all; bears well; keeps all winter, under good conditions, or may be brought out in December; is large and very fine. Lawrence is excellent, aromatic, productive; keeps well; and is valuable. All pears should be thinned for the best results.

[Reply of T. C. Thurlow of West Newbury.]

I raise the following varieties of pears; viz., on standard trees, Bartlett, Sheldon, Lawrence, Buffum, Doyenné Boussock, Clapp's Favorite, Onondaga, Seckel, Howell, and

Abbott; on standard and dwarf trees, Beurre d'Anjou, Urbaniste, Rostiezer, Doyenné d'Été, Belle Lucrative, and Vicar of Winkfield.

My soil, most of it, is strong clayey loam, part is good sandy or gravelly loam; but the first is best. The subsoil is gravel, with a little clay. The soil is enriched once in three years, on an average. I would like to enrich every year on the surface, in the fall, with any kind of manure. I prefer to prune a little every year in summer, say in June; though early in spring is a very good season. We have sometimes seen a very little of the blight, but not often: we have cut away and destroyed any diseased tree, or branch of a tree. The "slug" sometimes troubles young trees. These can be easily destroyed by dusting them with a little dry ashes or air-slaked lime. No other insect troubles our pear-trees to any extent. For the most profitable pear-trees to set out, I should generally prefer standards, and should recommend them to my customers, because they are hardy, and will last longer under ordinary cultivation. The dwarf pear, especially on the quince, is very liable to be killed in the root, and is short-lived generally. I pick the summer and fall varieties one or two weeks before they are ripe. The winter varieties we leave on the trees as long as possible, or till there is danger of freezing. It depends upon the weather and circumstances, how long after picking they are ripe enough for eating. We keep them best and longest in a cool, dry place, in thin layers. Winter pears should be barrelled up, and put in a cool, dry cellar.

The ten varieties recommended for profit by me are Bartlett, Lawrence, Beurre d'Anjou, Sheldon, Belle Lucrative, Beurre Bosc, Duchesse, Louise Bonne de Jersey, Bloodgood, and Seckel, in the order named; because these are the most hardy, productive, and popular in the market.

[Reply of Aaron Low of Essex.]

The soil on which they were grown was rather heavy loam, with a clay subsoil, enriched yearly around small trees, and every other year around larger trees, with stable-manure, ashes, and bone-dust.

I prune lightly every spring, and have not been troubled with blight or insects.

The most profitable pear-trees to set out are standards for most kinds; dwarf for the Duchesse and Vicars.

I pick my pears when they will part freely from the tree. Different kinds of pears vary in ripening: some are ripe in a week or two after picking; others will keep a number of months, keeping best and longest when kept as cool as possible.

The ten varieties recommended by me for profit are Bartlett, Sheldon, Louise Bonne de Jersey, Belle Lucrative, Buffum, Beurre d'Anjou, Beurre Bosc, Duchesse d'Angoulême, Lawrence, and Vicar of Winkfield.

Pear-trees should not be manured very heavily, for the reason, if they make too large a growth, they are more apt to winter-kill, as the wood does not get hardened up and ripe enough to withstand severe cold.

Bartletts, Louise Bonne de Jersey, Buffum, and Vicar do better if the fruit is thinned out when small, as these varieties are very apt to overbear.

[Reply of J. Henry Hill of Amesbury.]

The soil is a gravelly and clay loam, with a subsoil from a coarse gravel to a hard clay, enriched annually with stable-manure and ashes. I have never used any commercial fertiizers on my trees, but consider flour of bone and German salts good for all varieties of fruit.

I give my trees an annual pruning, using a sharp knife. I do not let any limbs that should be removed grow large, but prune when small, and then it will make no difference about the season. If the tree has been neglected until the limbs that should have been removed grow large, I would advise cutting them either in November or June. My trees have been free from blight and insects.

The most profitable tree to set out depends on the nature of soil, amount of land to be planted, and number of varieties wanted. For heavy clay loam I should plant dwarfs. For light, gravelly, or sandy soil, plant standards by all means; because standards in the garden would require too

much garden-room, and give too few varieties, while dwarfs, properly planted (two inches below the union), can be set closer, giving a large number of varieties and quicker returns.

When, by taking hold of the pear, it will readily separate from the stock, then I consider is the proper time to pick the pears. It depends on the temperature of the weather — whether warm and dry, or cool and moist — as to how soon after picking they will be ripe enough for eating.

I keep them best in my cellar, which is cool and dry, keeping them in shallow boxes, closely covered. I put a half-inch of hard-wood sawdust in the bottom of the box, laying the pears in very carefully to the depth of from four to six inches; then cover with paper, placing a mat or blanket over the paper to keep all close.

A person who is about setting pear-trees should be very particular in selecting them, never setting poor trees, as they are dear at any price. Procure your trees of some responsible nursery-man, and, if possible go, and select the trees yourself, and see them properly dug and packed. Having your ground thoroughly prepared, all mutilated roots should be smoothly cut, and you should see to it that the trees are properly set, and the soil well packed about the roots; then set a stake, and secure your tree properly to it; have the tops thinned out, and cut back two-thirds of last year's growth, and then give good clean cultivation and an annual trimming and dressing.

APPLES.

BERKSHIRE.

[From the Report of the Committee on Apples.]

The apple blessing has been an abundant one this season, and the exhibition at the fair has been correspondingly large and fine. The finest fruit was exhibited by the farmers living at the base of the Taconic range of mountains, where the wash from the decomposing rocks has made a soil peculiarly well adapted to fruit-culture, and where the mountains afford protection from blasting winds, and the slope is favorable for genial sunshine. To these natural advantages Messrs. Curtis, Candee, Spurr, and other fruit-culturists of this favored locality, have added close observation and careful culture, and the result is fine fruit and first premiums. All parts of the county made a good exhibition of apples this year; and Berkshire has shown herself capable of competing, in the production of this most valuable of fruits, with the most favored parts of the country. The Mississippi Valley may furnish larger specimens; but they are not so saccharine and high-flavored as those grown on our own sunny slopes. This is manifest to the taste of a connoisseur, and is apparent to any one who compares the cider made from Eastern and Western apples. That made from the latter has the watery appearance and flashy taste of our September cider, and lacks the body, color, and flavor of the November article, such as discriminating Eastern farmers put up for their own use.

The complaint has been made this fall, that apples are superabundant, that the supply is greater than the demand, and that it does not pay to raise apples. We have no sympathy with such croakers. Some folks would complain, as did the Israelites of old, if the heavens should rain down abundant food. This would damage the market for wheat

Complainers against a bountiful harvest of apples should remember that there never was a year when every poor family had all the fruit they desired, or as much as would be conducive to their comfort and health. If the producers of a superabundance would distribute a few barrels among their poor neighbors, or send some to the homes of orphans and the asylums for the aged and homeless in our cities, their complaints would be exchanged for thanksgivings.

Orchardists should also provide more liberally than is their wont for the supply of their own households. The home-market literally, that is, the market in one's own family, is the best in the world. There is no sense in a shoemaker's wife going without shoes, nor in a producer's family going without produce, or being supplied with the refuse, such as will not sell at the highest price. "The laborer is worthy of his hire;" and, if he can be paid in kind, it should by all means be kindly paid. There is no fruit so conducive to health, or so congenial to most stomachs, as the apple; and if each member of a family could be supplied daily with half a dozen through the entire year, — as can easily be done with a little painstaking, — there would be a great saving of doctors' bills, less complaint of dyspeptic stomachs, and no complaint at all of a superabundant production.

Then, again, apples are worth much more to feed to stock than is generally supposed. Professor Salisbury makes them to be almost as valuable as potatoes for feeding. Besides the direct nourishment they afford, the stimulus given to digestion by apples makes them a valuable appetizer. All domestic animals are extravagantly fond of apples. Horses, cows, sheep, and swine are inclined to eat them too greedily at first, if allowed a free range among them. Moderate rations of apples should therefore be fed till the animals become accustomed to them. A peck per day at first for a horse or cow will do no damage, and the ration may gradually be increased to half a bushel, producing great vigor in the former and a great flow of excellent milk in the latter. Sheep and swine also thrive on an apple-diet, and the mutton and pork produced are healthy and well-flavored.

The late-keeping varieties of apples may be preserved for a year or more by careful picking and packing, and exclusion from light and air, at a uniform temperature just above

freezing. During the winter they keep well buried in the ground; but in the summer they must be surrounded with some non-conductor of heat and moisture, such as paper, dry chaff, or dry pine-leaves. Perhaps the best preserver of apples is plaster (gypsum). A barrel of Roxbury russets, with all the interstices well filled with plaster, can be kept two years.

ALEXANDER HYDE, *Chairman.*

HINGHAM.

[From the Report of the Committee.]

We in New England are learning to grow finer fruits. The worm-eaten and defective fruit which negligence gave has been superseded by almost perfect fruit: this has resulted from more careful attention to the situation and health of our orchards. Even with the abundance of this valuable fruit the present year, the quality has never been excelled. In such a year as this, the intelligent, thoughtful farmer must decide wisely what disposition he will make of his apples. If he makes cider, and feels confident he is placing no evil temptation in the way of his family, he will have the satisfaction of doing just what nine-tenths of his neighbors are doing, though, we think, with very little chance for profit. The cider-maker, with his improved appliances for manufacture, has the advantage of the farmer, who is obliged to pay him an excessive toll. We believe apples as a winter food for stock are as cheap as root-crops.

From Professor Goessmann's investigations in fruit-culture, which are based on a chemical analysis of the apple at different periods, it appears, that, early in the season (about the time of harvesting), it is not very valuable, except for young stock. The apple at this time contains a large amount of starch, which the ripening process converts into sugar. The time of this change varies in different varieties. From December to April the apple is a very valuable food for stock, and may take the place of roots which are more expensive. We therefore advise farmers to try the experiment, using as much caution as in feeding grain, and we doubt not they will be pleased with the results.

I. HENRY EASTERBROOK, *Chairman.*

INDIAN CORN.

WORCESTER SOUTH-EAST.

[Statement of J. D. Hunt.]

My crop was raised on 138$\frac{2}{3}$ square rods of land.

The crop in 1876 was hay, with no manure applied on the land.

It bore a crop of corn in 1877: three cords and a half of cow-manure were applied.

The soil is a black loam, with clay or hard bottom. Two cords of cow-manure were spread on the land in spring, previous to ploughing, — the first time May 5, the second time May 16. The land was ploughed about six inches deep, then furrowed both ways three feet, four inches wide, and about six inches deep; manured in the hill with two cords cow-manure from the barn-cellars, and worked over once beside carting, and making four cords of manure on the piece of land.

The corn was planted May 20 and 21, with eight quarts of Vermont yellow seed of small cob and large kernel.

The following is the cost of the field of corn: —

Ploughing first time	$3 50
Ploughing second time	2 50
Furrowing	2 00
Manuring in the hill	3 00
Planting corn	3 25
June 19 and 20, ploughing and hoeing corn	4 50
July 6 and 7, ploughing and hoeing corn	4 00
Eight quarts of seed-corn	50
Four cords of manure, at $7	28 00
Sept. 26, cutting stalks, binding and carting	3 50
Oct. 18 and 19, cutting corn and carting	4 25
Oct. 26, husking corn	6 25
Interest on land and taxes	3 75
	$69 00

Cr.

Oct. 20, by 200 bushels of ears of corn, or 114 bushels of shelled corn, 86 cents per bushel .	$98 04
By 1,000 pounds stalks	5 00
About 2,500 pounds of husks	7 00
	$110 04

Cost of corn per bushel, 49 19-114 cents.

Milford, Oct. 26.

PLYMOUTH.

[From the Supervisor's Report.]

There were three entries for the best experiment in raising corn at the least cost per bushel.

	Amount per Acre.	Cost per Bushel.
E. B. Thompson of Halifax . . .	$42\frac{2}{9}$ bushels.	32 cents —
R. M. Littlefield of East Bridgewater .	$51\frac{2}{5}$ "	$32\frac{1}{2}$ cents +
A. L. Covington of Middleborough .	$43\frac{3}{4}$ "	55 cents —

It will be understood, that, in awarding the premiums under this head, more responsibility than usual rested upon the supervisor, who, in addition to the inspection of the crop and the method of cultivation, was required to take into consideration the previous condition and past treatment for a number of years, of the land upon which it was grown, and also its condition with regard to a future crop. Between Mr. Thompson and Mr. Covington there was no apparent difficulty in this respect, as their land was thought to be very nearly alike as to previous condition and treatment, and they both used nearly the same kind of fertilizer, — Peruvian guano; the only essential difference being, that Mr. Covington used more, and applied a part under and a part on top of the furrow, while Mr. Thompson's was all put under. This, in a dry season, is probably the best method, especially in a light, dry soil. The increased cost of Mr. Covington's corn per bushel over Mr. Thompson's will be found partly in his labor account. This is his first appearance as a competitor

for premiums on produce; and, while intent on raising a good crop, we think he did not fully realize that his success in this instance depended very largely on the minimum amount of labor with which he could produce that crop. Between Mr. Thompson and Mr. Littlefield the case is very different.

While the land of Mr. Thompson is very light, and has lain nearly idle for several years, that of Mr. Littlefield, though previously in a wild, unproductive state, has for the last two years been planted to corn, with nearly the same treatment that it has received this year. Instead of guano ploughed under, Mr. Littlefield has used stable-manure applied in the hill. One of the most difficult questions to decide has been, what is the relative proportion of the fertilizer and manure now remaining in the soil unused by the crop of this year. Another of nearly equal importance, in connection with Mr. Littlefield's, is, how much, if any, of the dressing of the last two years, should be charged to the crop of the present year. If the dressing of this year was not all exhausted by the crop of this year, of course that of previous years was not by the crops of those years, and therefore the present crop has been benefited by those portions remaining.

With regard to the fertilizer applied by Mr. Thompson, it is usually safe to consider such as exhausted the first year, or, if some of its virtues still remain unused, that the crop has taken enough of the elements previously existing in the soil to balance those of the fertilizer remaining. The extreme drought, however, would seem to make this year an exception to that rule, as it is generally acknowledged that commercial fertilizers do better in wet than in dry seasons; the reason being, that the moisture of the wet season dissolves the fertilizer, so that its nutritious elements can be readily absorbed and appropriated by the growing crop; while, if it is not so dissolved, a portion at least of its virtues would remain in the soil for the benefit of future crops; which we believe to be the fact the present year. We do not doubt that there is more of the manure applied to Mr. Littlefield's crop remaining in the soil than of the guano applied by Mr. Thompson; but we believe that that excess is fully balanced by the benefit derived by the crop of Mr. Littlefield from the remains of former dressings. We have therefore decided to reckon in both cases one-third of the dressing applied the

present year as unused, and remaining in the soil, and to make no account of the benefit derived by Mr. Littlefield's crop from the dressings of previous years.

In our estimate of the cost per bushel we have taken eighty pounds of ears as equal to one bushel of shelled corn. As corn was unusually dry when harvested this year, we think it will be fair to do so, and will give a more truthful result of the cost per bushel than to reckon eighty-five pounds of ears to the bushel, as we usually do. It will, of course, make no difference to the competitors either way, only in the apparent number of bushels. In order to arrive at a fair and impartial verdict to all parties in awarding these premiums, we have compared and adjusted their several statements with each other, and with all the facts and circumstances known to us in connection therewith, as well as we could. Neither of the parties has made as full and detailed a statement of the time employed and price per hour as could be wished. Mr. Thompson, however, informs us that he allowed twelve cents and a half per hour for a man, and fifteen cents per hour for his oxen; and we have taken that as a basis, and in our arrangement made the others conform as nearly as possible. We have allowed, as stated before, for one-third of the applied dressing as remaining unused, and have credited the stover in each case at fifteen dollars. The following is a statement of the comparative expense of the three crops as arranged by us, and on which the award is based: —

Expenses.	Thompson.	Littlefield.	Covington.
Two-thirds of fertilizer applied	$9 74	$13 33	$12 83
Ploughing and other preparations . .	2 50	2 50	6 50
Seed and planting	2 90	2 50	2 68
Cultivation	5 00	5 00	6 54
Harvesting, &c.	7 50	7 00	9 50
Taxes and interest on land	84	1 40	1 00
Total expense	$28 48	$31 73	$39 05
Deduct for stover	15 00	15 00	15 00
Net cost of corn	$13 48	$16 73	$24 05

[Statement of Ephraim B. Thompson of Halifax.]

The acre of land which I entered for the society's premium for the most successful experiment in raising corn at the least cost per bushel is a light sandy or gravelly loam, sloping to the north; had not been ploughed for six years, and for the last three years had not produced grass enough to be worth mowing, except a few rods across one end. The first week in May I ploughed under three hundred and fifty pounds of rectified Peruvian guano, seven inches deep, using what is called the Doe plough, and harrowed it at once. May 15 it was planted, four kernels in a hill, three feet and one-half apart each way, without any dressing in the hill. June 1 it was cultivated once in a row each way, and hoed. On July 1 I cultivated one way, and the last of July cut up all weeds that had made an appearance. Sept. 1 I cut and shocked the stalks, — one hundred and eighty bundles. Oct. 4 I cut up the corn, which was much dryer than usual at the time of harvesting, and hauled it to the barn. The entire weight of the acre of corn in the ear was 3,378¼ pounds, one hundred and thirty pounds of which was unsound or pig corn. The stover I think worth as much as a ton of English hay, or fifteen dollars. The corn I planted was a yellow variety, with large kernel and small cob. It is two weeks earlier than, and produced as much as, the Whitman corn.

[Statement of R. M. Littlefield of East Bridgewater.]

It appears by Mr. Littlefield's statement that his corn was planted on a light sandy soil that had been planted to corn the past two years, and treated very nearly the same as this year. It was ploughed about the 25th of May, seven inches deep, and marked out one way in rows three feet and nine inches apart. About the first of June he planted ten quarts of yellow corn in hills two feet and a half apart, putting two cords and a half of stable-manure in the hill. Cultivated once in a row two times, and hoed once. The crop was harvested in October. The total weight of the corn was 4,112 pounds, seventy pounds of which was pig-corn.

[Statement of A. L. Covington of Middleborough.]

Mr. Covington's corn was grown on a light sandy or gravelly soil which has been in grass for fifteen years or more, producing hardly enough to be worth mowing. It was ploughed about six inches deep last fall, and again this spring, turning under four hundred pounds of guano. Two hundred pounds more were spread on the surface, and harrowed in, after which the land was bushed and furrowed one way, three feet and a half apart. May 10, planted in hills two feet and a half apart, using seven quarts of the Whitman corn, and putting three kernels in the hill. Cultivated and hoed twice. The stalks were cut and shocked about the first of September. Cut up and got in the corn the fore part of October. The entire crop weighed in the ear thirty-five hundred pounds and one-fourth, two hundred and eleven pounds of which was pig-corn. Mr. Covington estimates the fodder at about eight dollars.

[Statement of John Lane of East Bridgewater.]

The land on which my corn, entered for premium, grew, is a strong, moist black loam, with a clay subsoil. It has been in grass for several years, and a part of it was dressed with manure last year. Last fall it was ploughed seven inches deep. I hauled out manure in the winter, and in the spring spread broadcast twenty-four loads, of thirty bushels each, of good stable-manure, and harrowed it in with a Randall harrow. It was planted May 15 with yellow corn, four kernels in a hill. No dressing was applied in the hill. It was ploughed once between the rows, cultivated once, and hoed twice. I cut up and shocked, Sept. 25, all but two rods selected by the supervisor as an average. Oct. 11 those two rods were harvested and weighed, yielding at the rate of 88$\frac{60}{85}$ bushels to the acre. I think the fodder worth twelve dollars; manure unused, fifteen dollars. The expenses of ploughing, harrowing, and furrowing, were six dollars and a half; manure used by the crop, twenty-seven dollars; seed and planting, three dollars and a half; cost of cultivation, six dollars; harvesting, eight dollars; total, fifty-one dollars.

[Statement of George W. Humphrey of Rochester.]

It appears by Mr. Humphrey's statement that he planted about twenty-one acres to corn the present year, about five acres of which had been in grass for the last two years, and the balance planted to corn last year, manured with eight hundred pounds of Brighton fertilizer and seventy-five pounds of muriate of potash to the acre. The land was ploughed last fall about six inches deep. In the spring, about eight tons and a half of Darling's animal fertilizer was sown broadcast with a machine, and harrowed in with the Randall harrow. The land was then bushed and marked both ways, three feet and a half apart. It was planted with a hand-planter about the middle of May, a man being able to plant about four acres per day. After planting, it was again bushed, to insure the filling of all the holes made by the planter. The corn came up evenly and well; the rows were straight; and (no manure having been used) there were but few weeds, making the cost of cultivation small. About half the corn was cut up and shocked: the rest, left to ripen in the field, was husked from the hill, and the stover then rolled down and ploughed under. There were 81,160 pounds of sound ears, which, reckoning eighty pounds equal to one bushel (which is thought to be a fair estimate), would make 1,014½ bushels of shelled corn. No account was kept of the unsound ears, of which there were, probably, some forty baskets. The expense of the crop was very much lessened by the large size of the fields and the use of improved machinery. Mr. Humphrey thinks, that, if the stover had all been saved, there would have been about thirty-six tons, and he estimates it to be worth eight dollars per ton; but, as hay is low this year, six dollars per ton would probably be nearer. The account of the crop is as follows: Ploughing twenty-one acres, thirty-one dollars and a half; fertilizer and applying, three hundred and forty-two dollars; harrowing, nine dollars; bushing twice, four dollars and a half; marking, seven dollars and a half; seed and planting, nine dollars; lines, &c., four dollars; cultivating, twenty-one dollars; hoeing, fifty-two dollars and a half; shocking, thirty-one dollars and a half; binders, five dollars; husking, sixty

dollars; housing corn and stover, forty dollars; total, six hundred and seventeen dollars and a half. Deduct thirty-six tons of stover at six dollars per ton equals two hundred and sixteen dollars, and leaves four hundred and one dollars and a half as the net cost of the corn, which will be about thirty-nine cents and a half per bushel.

[Statement of Albert Thomas of Middleborough.]

My corn grew on a dark, sandy loam which was in grass without dressing the past two years. This spring it was ploughed about eight inches deep, well harrowed and furrowed. Forty loads of good manure were ploughed in. It was planted on May 8, with one peck of Whitman corn in hills three feet by three feet and a half apart, putting a little compost in each hill. Cultivated both ways three times, and hoed. I cut the stalks at the usual time, and harvested in October. One rod was previously selected as an average, which produced at the rate of $85\frac{55}{85}$ bushels to the acre. I estimate the fodder to be worth thirty dollars, and think one-half of the manure is left in the ground. Expenses: ploughing, harrowing, &c., seven dollars; manure used by the crop, thirty dollars; seed and planting, two dollars; cultivation, eight dollars; harvesting, five dollars; total, fifty-two dollars.

We think Mr. Thomas values his fodder pretty high for this year, and that he puts the labor of harvesting rather low.

FIELD-CROPS OF VEGETABLES.

ESSEX.

POTATOES.

[Statement of J. B. Knight.]

The crop of 1876 and 1877 was grass, no dressing applied: the soil is a rather heavy loam. For the crop of 1878 the ground was ploughed in the fall of 1877 seven inches deep, at the cost of four dollars per acre. About eight cords per acre of barnyard-manure were hauled on the ground in the spring of 1878, at an estimated value of four dollars per cord, and cut in with the wheel harrow.

It was planted with Early Rose potatoes the first and second week in May, using the small or medium size, taken from the pile put in in the fall for market, — about twelve or fourteen bushels per acre, at an estimated cost of twelve dollars per acre, for seed and planting. They were planted in rows three feet apart, and three feet between hills. The cultivator was passed between the rows before the potatoes came up; after they came up, they were cultivated and hoed twice, at a cost of six dollars per acre. They were harvested the latter part of September, at a cost of eight dollars per acre.

A part of this piece was planted with one potato, of small or medium size, in a hill, and a part with a large potato cut in two, with one piece to a hill. Where the whole potato was planted, the appearance for the first part of the season was much more forward than where the piece was planted, and I think that a good start in the spring has much to do with the crop late in the season, and the harvesting of this crop goes far to confirm this opinion.

The yield was a hundred sixty-four bushels and a half, of sixty pounds to the bushel, of merchantable potatoes. The extent of the piece was ninety-four rods.

ONIONS.

[Statement of G. A. Randall of Newbury.]

The crop raised upon this land the past three years has been onions. The ground was ploughed in the fall of 1877, and manured with compost manure, about one part fish and four parts cow and horse manure, which was spread on top after ploughing, at the rate of about eight cords to the acre, and laid until spring, and was then ploughed in, the land harrowed, brushed, raked, and sowed at the rate of four pounds of seed to the acre. Land rather light loam. The crop was hoed six or seven times with a wheel hoe, and weeded three times.

This half-acre was surveyed by J. N. Rolfe, and is a part of a six-acre bed, and I think four acres of it produced nearly as many onions per acre as the half-acre which I enter for premium. The crop was harvested about Sept. 10. Two loads were weighed by Daniel Lunt; the others were loaded as near like it as possible, in the same carts, making three hundred and seven bushels on the half-acre.

Cost of ploughing and harrowing	$4 00
raking and sowing	3 00
hoeing and weeding	20 00
harvesting	8 00
manure	24 00
seed	3 00

The crop has been sold at two dollars and ten cents per barrel, including barrel. The above statement is correct, to the best of my knowledge.

CABBAGES.

[Statement of J. J. H. Gregory.]

The crop of cabbages entered for premium are the Early Brunswick, commonly known as the Fotler Cabbage. They were raised in Middleton, on "Bear-Hill" Farm. The piece was of about two acres. It was planted from June 16 to 20.

Owing to the drought, nearly half of the piece had to be set with plants taken from the portion first planted, which, having the advantage of a shower just after the seed was put in the ground, came up very uniformly. More or less of transplanting was done up to the latter part of July; but, the growing season being unusually prolonged, about every plant on the piece made heads of good size and hard. Towards the close of the season, a few hundred were started to prevent the heads from bursting. I have noticed, that, on what might be termed country farms as distinguished from those on the seaboard, cabbages are far less likely to burst their heads; which I attribute to the fact that the ground is not so filled with manure, not having been so long in tillage, nor so highly manured by the annual dressing of the soil. This fact is of value to the farmer, as he can safely plant his late cabbage earlier in the season, and get as large and as hard heads as on the seaboard, with less manure, the extra length of season for their growth being an equivalent. In saying this, I would not be understood to state that large and hard heads can be got without liberal manuring, but simply that — as the bursting of the heads brings to an end all profitable growth, and they are more apt to do this, and at an earlier day, on the rich lands of the seacoast — the country farmer can count on this extra season for growing as an equivalent for a proportion of the manure that his seaboard brother is compelled to use.

The land had for the two previous years been devoted to the growing of onion-seed, and had consequently received liberal manuring; though of the varieties and quantities applied I have no record. The soil being very moist, and having many large bowlders (weighing from a few hundred pounds up to several tons) scattered over the surface, last spring I had it tile-drained and cleared of stone. In June I applied a compost, composed in part of fish-waste and soil, and in part of glue-waste and soil, — about one part fish-waste to four parts soil, and one part glue-waste to two parts soil, — six cords to the acre. This was ploughed in. After harrowing and furrowing out, I had applied to each hill (the rows were three feet apart, and the hills nearly three feet) one-third of a shovelful of a compost made up of one part bone-dust, well decayed, two parts Riverside superphosphate, ten parts

ashes, and twelve parts of the fish-and-glue compost. The cost to me of the fish-and-glue compost was about three dollars a cord; that of the compost used in the hills, very nearly two-thirds of a cent for each hill, the materials entering into it having been purchased wholesale.

The soil was strong loam, about seven inches deep, with a subsoil of admixture of sand and clay. In preparing the land it was ploughed but once,—about seven inches deep. The cost of ploughing, harrowing, and furrowing, I should estimate, per acre, at eight dollars. The quantity of seed was half a pound to the acre, at a cost of two dollars. The cost of planting the seed I should put at two dollars per acre. The crop was cultivated and hoed three times, at a cost of thirty dollars per acre. The thinning and transplanting I put at five dollars per acre. As the cabbages were for seed purposes, the cost of harvesting could hardly be estimated. As to the value of the crop, at the time it was gathered seed cabbages were worth about eight cents each in Boston market.

NEAT-CATTLE.

FRANKLIN.

[From the Report of the Committee.]

"The steer, the heifer, and the calf
Are all called *neat*."—SHAKSPEARE.

The old Saxon word from which we derive our "neat" means desirable, useful, and perhaps desirable because *so* useful, and, so applied to our bovine animals, is certainly most appropriate; for we have no domestic animals so indispensably desirable, and completely useful from hoof to horn, from hide to heart, and from early life to and after death, as neat-stock.

The trustees, possessed with a commendable spirit of economy, in accord with the times, and in keeping with the finances of the society, in cutting the premium list, omitted altogether certain breeds heretofore classed on an equality with the popular and fashionable Short-horn and Jersey. The position taken was, that so few of the rejected breeds were owned within the society, that competition was impracticable. This opens the question as to the real object and purpose of an agricultural society and its exhibitions, — whether its premiums should be offered exclusively for what there *is*, or sometimes for what there *ought to be;* that is, whether the society as such should not keep in advance of its members, and seek to promote the introduction of other, and, for local purposes, better breeds of animal and vegetable life. Of course, if, in the judgment of the trustees, the Short-horn and the Jersey fill the bill for every locality and every farmer within the society, then no other breed should be sought, encouraged, or tolerated. But if, to any considerable portion of the membership, the value of milk is determined by the quart-measure instead of the lactometer, or their grazing-lands are of such a character that their herds have literally to toil for a living,

so that the lazy Durham would fail while the industrious Ayrshire or nimble native might succeed, to such it would seem desirable that encouragement should be given. However this may be, the society, if wrong, will set itself right in the future as in the past.

It is not our purpose to discuss the advisability of the use of thorough-bred neat-stock: the day when there was necessity for such discussion with the farmers of Franklin County has passed. It is not within our purpose to present the merits or demerits of any of the favorite breeds. They all have both, which have often been discussed by better qualified and abler champions than ourselves. We will occupy the little space alloted to us in considering the retrogression in neat-stock farming in Franklin County.

In all ages and in all countries the prosperity of the people has been measured largely by the number of their flocks and herds. Job was the most patient and happy man only when he had fourteen thousand eight hundred sheep, a thousand yoke of oxen, six thousand camels, &c. Such is the constitution of our mother-earth, that no system of agriculture can, in any locality, be for a long time successful without the compensations of domestic animals.

It has been very thoroughly demonstrated by repeated censuses of the United States, that every hundred inhabitants require eighty neat-cattle. From 1830 to 1860 the increase of neat-stock kept exact pace with the population, being in the same ratio of eighty per cent. It was further demonstrated, that, of these eighty cattle, eight should be working-oxen, and this number, for the period named, did not vary a single per cent; and that, of the eighty cattle, twenty-eight should be milch cows, and the same relative proportion was maintained for the thirty years, also without the variation of a single per cent. From 1860 to 1870 there were disturbing causes which affected the maintenance of the quota of neat-cattle heretofore determined to be normal and necessary; viz., the war, the introduction of farm-machinery, and, very generally, a better grade of cattle. By the census of 1870 we find only seventy-four neat-cattle to the hundred inhabitants, and of these only three and a half were working-oxen, while twenty-four were cows, and forty-six and a half other cattle. It will be noticed that the working-oxen

have decreased nearly fifty per cent from 1860 to 1870, of which we shall have something to say farther on.

To bring these statistics home to our own State: in 1840 we had thirty-eight neat-cattle to every hundred people; in 1850, twenty-six; in 1870, fifteen; and, in 1875, fourteen. Thus we find Massachusetts produces but about one-sixth of the beef, milk, butter, and cheese consumed within her borders; and it is no wonder that the trains from the north, east, and west, are burdened with stock-cars for our markets. This large decrease in the proportion of cattle to people is not so much owing, however, to the decrease of cattle as to the increase of population; for while, for twenty-five years, the neat cattle show a comparatively small decrease, the population has nearly doubled. The total decrease of neat-stock in this State from 1850 to 1875 amounts to thirty-five thousand head out of a total of two hundred and sixty thousand; and it is noteworthy, that, of this decrease of thirty-five thousand, thirty thousand three hundred are from the class of working-oxen alone.

To come into our own county: we find sixty-four neat-cattle to every hundred inhabitants, — a deficiency equal to one-fifth of the number required to supply the demand within the county. To show that we are at fault in the matter of the production of neat-stock, it may be stated, that, in agriculture, Franklin County is just about on a par with the average of the entire country. We have engaged as farmers and farm-laborers fifteen and one-third per cent of our population; and in the United States this class comprises sixteen and two-thirds per cent. Of our neat-cattle, five are working-oxen, thirty-one cows, and twenty-eight other cattle; from which we infer that we produce in the aggregate a surplus of milk, butter, and cheese equal to one-eighth of our entire product, while we produce only four-fifths of the beef consumed within the county. To go back no farther than 1870: we find in 1875 our working-oxen had decreased during the five years thirty-five per cent, our sheep had decreased thirty per cent, our other cattle about one-half the same rate, while milch cows alone show an increase of fifteen per cent. If we had space, we might follow these statistics to their natural and inevitable result, and we should find, as is the fact, that, for the same period, there has been a

decrease in all the great staple products of the farms in our county, especially of hay and grain. Less cattle mean less manure, and less manure means less hay and corn.

The very great decrease in the number of working-oxen now owned and kept in this county is worthy of special consideration. In Montague there are but one-fifth as many working-oxen as twenty-five years ago. In Wendell, some fifty years ago, we remember an occasion when sixty pairs of cattle, including, of course, many properly classed as steers, were harnessed in a single string to a sled, for "breaking out the roads;" and these cattle were all owned and kept in one school district in that town; and it is fair to assume that the number of working-cattle in the town of Wendell fifty years ago went well up into the hundreds. In 1875 only eighteen pairs of oxen were found in that town: so throughout the country is there a growing decrease and disuse of the ox. Why is this so? Our boys have come to dislike the dull ox as a power on the farm: he is too slow, too stupid, and too clumsy. Especially is this the case in working modern farm-machinery. The mower, the tedder, the rake, and the fork are more readily, more rapidly, and it is thought more economically, worked by the horse than by the ox; and perhaps herein lies the great reason why the horse is crowding the ox from the farm.

The real question, however, lies back of this; viz., Is it good economy for a small farmer, say one who cuts from ten to fifteen acres of grass, to employ machinery for that purpose? It is all very fine to talk about drudgery on the farm, about giving the farmer time and opportunity to cultivate his higher faculties, with the thermometer at a hundred in the shade, by using labor-saving machinery. We have found a sun-bath on such a day, in the hay-field, healthful, profitable, and agreeable, and consider the question of the use of machinery largely as one of profit and loss. We suspect our farmers are not keeping strict accounts with their machinery, and would be surprised to be told that it costs them considerably more to do some of their work by machinery than in the old-fashioned way.

Without wishing to disparage or condemn the use of machinery, we say without hesitation, if one must go, give us back the ox, and take away the machines; for in our view the

growing disuse of ox-labor in favor of horse-labor on farms is an error. Many of the arguments brought against the use of ordinary oxen on the farm have no force against the trained ox. We were surprised and delighted, as every person must have been who witnessed the exhibition of Mr. Morgan's trained oxen and steers, at the capabilities of the stupid ox. The proper sphere of labor for the ox is on the farm; and we should have been better pleased to have seen these oxen *perform* in the yoke, and with the cart. The two most difficult practical feats to thoroughly educate into a pair of oxen are backing, and moving sideways to the right or left. These cattle executed both manœuvres *without a yoke* perfectly. The question was, what they would have done in practical life, with a yoke and reasonable load. In our exhibitions of trained cattle we think our committees and exhibiters mistake in overloading their teams. It should not be a question so much of drawing or backing a hundred pounds, more or less, as carrying themselves evenly and uniformly to the best advantage. It is not enough that a pair of oxen are capable of forcing a given load backward or forward a certain distance: they must be able to do it within certain limits of space and time; and as rapid motion is of quite as much importance as great strength in the ox, for ordinary farm-purposes, we should like to see a trial of walking for the steers as well as trotting for the colts.

The United States, soil and climate considered, is the best cattle country in the world. Franklin County has some of the best grazing-lands, and is not behind the average of this great country in its capabilities for cattle products. We have shown that the number of cattle in the entire county is not sufficient to supply the natural and usual wants and demands of our own people; at the same time a new enterprise has been entered upon by which immense numbers of our neat-stock and other animals are to be exported to England, and eventually to other countries deficient in meat product. This extraordinary demand, in addition to our home consumption, must enhance the price of beef and mutton, and make neat-stock and sheep-husbandry profitable above that of any other employment on our farms for many years to come. Let the farmers of Franklin County be wise to improve this their opportunity to increase their flocks and

herds, to redeem the waste places, and make the old and neglected homesteads joyous with renewed life in the midst of fruitful fields of grass and grain.

R. N. OAKMAN, *for the Committee.*

MILCH COWS.

HINGHAM.

[From the Report of the Committee.]

Of the different branches of farming there is none of more importance than the dairy.

In the time of our fathers our farms were rich in natural fertility, and supported large herds without artificial helps. Although our farms have depreciated in natural fertility, the dairy has not only held its own, but has actually increased nearly if not quite twofold since that time. To-day the dairy is second to no other branch of farming throughout a large portion of New England; and the question arises, "Why is it so?" There are many reasons for it; and one of the most important is the improvement in cows and in the management of them. In place of large herds of native "scrubs," we have now our grades and pure bred cows with pedigree, showing their descent from great milkers. Where can the farmer be found to-day who has not either Ayrshires, Jerseys, Devons, or Short-horns, or grades of one or more of these breeds? One pure breed or good grade is of more value than three natives. The former will consume no more fodder than the latter, but will yield twice as much milk, and twice to three times as much butter, as natives averaged in the days of our fathers.

When I was a boy, cows that averaged five to six pounds of butter per week in the best of the season were considered good: now, good cows yield from ten to fifteen pounds, and some even more. In the management of cows there has also been a great change during the last thirty years. Then cows were not housed at night for milking till freezing weather, and seldom had any other feed than grass: now most farmers stable them at night the year round; and in the milk-rais-

ing districts they are fed with grain or green fodder to increase the quantity and quality of the milk. Another reason for the increase of dairy products is the increase of population, extending the demand for home consumption; also an export trade in butter and cheese to the amount of many millions of dollars annually.

Yet, with all this increased demand for dairy products, I find the number of cows in the State has increased but little.

For instance, in 1855 we had a hundred and forty-nine thousand cows, and twenty-eight thousand or thirty thousand heifers; in 1865 we had a hundred and fifty thousand cows, and twenty-five thousand heifers; thus showing, that, instead of the number of cows increasing in proportion to the demand, improved breeds and care have met the increased demand for dairy products.

Thus far I have spoken of improvement in cows and the management of them; now a few words for the cow herself, as too much cannot be said in her praise. Who does not like to see a good-natured cow, chewing her cud, and waiting patiently, as the day draws to a close, to yield her keeper the rich and bountiful supply of milk stored up by her during the day? She affords us veal, butter, and cheese, — all important articles of food, — and at last gives up herself for the sustenance of our race. We believe the cow is, without doubt, the most useful of domestic animals.

Therefore it is of the utmost importance that great care should be taken in selecting calves for rearing, also in feeding and managing them. To raise a good cow, it is important to select a calf from a well-bred cow that is known to be a good milker.

The sire should also be of good milking-stock, at least two years old, of good disposition, and, if a thorough-bred, so much the better.

The calf should feed from its mother two or three days, then learn to drink. It should have milk from the cow for two weeks; then some skimmed milk may be added, with a very little meal, always scalding and salting the meal before putting in the milk.

When the calf is three weeks old, give it skimmed milk and meal only; and gradually increase the quantity of meal to a pint a day, and continue this till the calf is about three

months old, and even longer if convenient, giving it at the same time plenty of good grass in summer, or rowen in winter, with the addition of a few flat turnips.

Follow this method, and nine-tenths of your calves will become good cows if properly treated when they first come to milk.

Care must be taken not to give too large quantities of milk at a time.

Four quarts, night and morning, is sufficient for most calves.

The cow should be carefully treated at all times, and have her wants as fully supplied as possible at all seasons of the year. In spring keep her in the barn or yard till feed in the pasture is well started. When the change from barn to pasture is made, it should be gradual, as there is danger of injury to her at this time. Give a foddering of good hay night and morning, and omit any extra feed, as meal or shorts. When the pastures begin to dry up, care should be taken not to let the cows "fall off." They require a certain amount of food to supply nature, and more than that goes either to beef or milk; and she should not be allowed to shrink in milk for want of proper food to make it. Of what this extra feed shall consist, or what is best, there are many opinions. I prefer green sweet-corn fodder, fed in the barn night and morning if necessary. It increases the richness and quantity of the milk, and the cows prefer it to other kinds of corn.

Hungarian grass is good; but, after a trial of both, I prefer the corn. Cows will eat it better, and it is a surer crop to raise. When cows have come to the barn, dry corn-fodder is of much value if properly fed. Many will not agree with me. Some think it of so little value as to use it for bedding and mulching. My way of preparing it for feeding is to cut and put it into the feed-trough with a few shorts (about one quart to a cow), then pour on hot water, and cover tight to keep in the steam, letting it stand from two to four hours before feeding.

Prepared in this way there is little waste, and cows do well on it; when fed only once a day, I prefer it at night. I have fed cows in this way all winter, and they came out in good order in the spring.

If the production of milk in winter is the object, I should say increase the quantity. of shorts, and add meal, — about two quarts of the former and one of the latter to each cow.

They will do much better on this than when fed on the best of hay alone. Milking is also very important. Many a good cow is spoiled by poor milkers. The first requisite is regularity of time. Another important thing is to let each cow have, so far as possible, the same milker from day to day. Be kind and gentle to your cows *always;* allow no boisterous talking in the stable, and no kicking or pounding of cows in *any* case. When milking, do it as completely as possible; for, by leaving a little every time, cows will soon decrease their milk. A heifer may be spoiled, or at least so injured that she will never after give as much milk as though she had been properly milked the first year. Much more might be said about cows and their management; but I will leave the subject for those of larger experience and greater ability than your humble servant.

GEORGE P. CHAPIN, *Chairman.*

SHEEP-HUSBANDRY.

HOOSAC VALLEY.

[From the Report of the Committee.]

Your Committee on lambs have attended to the duty assigned them, and find ten entries, viz., four fine-wools, four middle, and two coarse-wools; and they are glad to note a marked improvement over the last four years both in numbers and quality. It goes to show that our farmers are beginning to realize the vital importance of breeding sheep, for which we can always find a ready market at remunerative prices. The specimens of fine-wools shown were many of them as good, in our opinion, as were ever exhibited in the Hoosac Valley, even during the halycon days of Merinos; and the coarse and grade wools would cause the lovers of good mutton and lamb to smile at the thought of savory chops and roasts. We would, in this connection, confine our few remarks to the breeding and management of lambs.

The great mistake of most breeders is made in the management of the ewes and rams in the fall, or coupling-season, most of whom turn their rams loose to run with the ewes through the winter, and in very many cases without extra feed. The result is the loss of vitality in the ram, and tender and puny lambs, which require the greatest care to preserve their feeble existence. If the farmer wants good, strong, healthy lambs, he must preserve the vitality of his ram by good keeping, and, secondly, by keeping him away from the ewes, with the exception of a few hours each day, or what sheep-breeders more properly term "tending," which is by far the best way. We remember that George Campbell of Westminster, Vt., once told us, that should the best ram in Vermont be turned loose with one hundred ewes, and allowed to run through the winter, he never would be worth a shilling for breeding purposes afterwards; and we can get

no better authority than Mr. Campbell, who is one of the most successful breeders of fine-wool sheep in America.

It used to be the practice of most sheep-breeders in New England to have their lambs yeaned from the 10th to the 20th of May, particularly when we used to breed the Saxon and their crosses, as the lambs were tender, and devoid of wool, at yeaning-time; and the least scarcity of fall feed told very destructively on them, and left them small and weak when winter set in, in consequence of which nearly one-half of them perished before the close of cold weather. The best time, in our opinion, to have lambs come is from the 1st of April to the 1st of May, and we have tried March, April, and May. We have had Merino lambs dropped on the 15th of April which weighed one hundred pounds on the 20th of September. It is understood, of course, that lambs dropped earlier than May, in New England, must be yeaned in stables; but this, in reality, diminishes, rather than increases, the work of the shepherd, as the ewes are kept together, and no time is spent in traversing the farm in search of chilled lambs, and sheep which get cast and frequently die from exposure, having been overlooked by the shepherd (which is often the case in the yeaning-season), or driving the flock in at night before storms. The lambing-season may be got through with before the farmer commences his work in the spring.

Lambs coming in the stable are the safest, even in quite pleasant weather, provided the stable is roomy and well lighted, and provided the sheep are docile, and can be handled by the shepherd without crowding from side to side, and running over their lambs. While the stable should not be kept too hot and tight, it should be capable of being closed all round, and it should be so close that in a cold night the heat of the sheep will keep up a moderate temperature. On the other hand, the stable should be provided with ventilators, so that too much heat and impure air can be avoided.

Too much care is not necessary with hardy sheep in lambing, and too much interference is not as well for ewes or lambs. It is well to look into your sheep-shed before retiring for the night, and see if all is right, and, if so, leave the flock undisturbed until morning. We believe that a lamb that cannot get up, and suckle and take care of itself until morn-

ing, in a well-strawed, comfortable stable, is not worth raising. Some breeders make a practice of going round once in two hours through the night during the lambing-season. This may possibly be necessary among coarse breeds which are accustomed to have twins; for one of the pair is less likely to be missed by its mother if it gets separated from her. But, if the sheep are not extremely tame, more harm than good would result from disturbing them in the night.

The best of care should be taken of ewes having lambs, when shut up on dry feed, to produce a good flow of milk. The best grain we ever tried is oats and corn, ground (two-thirds oats), as it produces a large flow of milk, and keeps up the strength of the ewes. Lambs, also, should be taught to eat meal, which is easily done, when they are a week old, as they will do far better, and are not as liable to die for the lack of their natural nourishment (milk). Special care should be taken to give your ewes an abundant supply of water while suckling their lambs, as it is of the greatest importance to keep up their flow of milk.

Our experience in the care of new-born lambs may be of some benefit to those not having had that experience, and we desire to add a few words to our already too lengthy report. If a lamb can help itself from the outset, it is much better not to try in any way to assist it. If a ewe has an abundance of milk, and stands kindly for her lamb to suckle, and the latter is disposed to help itself, there is little danger; but if the lamb is weak, and makes no effort to help itself, the shepherd should at once go to its aid. The ewe should not be thrown down, if it can be avoided, but should stand in her natural position. The teat should be placed in the lamb's mouth, and its back and rump, about the roots of its tail, rubbed lightly with the finger, which it mistakes for the licking of its mother: this almost invariably produces an effort to suckle. If it does not, a little milk should be milked into its mouth, still keeping up the rubbing of its back with the finger; and, if this does not produce the desired effect, the lamb is either a fool, or very obstinate; but perseverance and gentleness will always triumph. We should never use a spoon or sucking-bottle, as it will cause the lamb to rely on that kind of food, even if the mother has a full udder of milk, which is far more natural, and much less trouble, than

feeding by hand. We are not so egotistical as to believe, nor do we pretend to say, that there are not others who have far better methods of sheep-breeding than your Committee; but we do believe and sincerely hope, that if the farmers of the Hoosac Valley will take the advice of your Committee, and use the best rams they can find (not scrubs), and keep on with the improvement of their flocks, the time is not far distant when they will say that they are glad they took the advice of your Committee.

JAMES H. GOODRICH, *Chairman.*

POULTRY.

BRISTOL.

[From the Report of the Committee.]

Out of the hundred and ninety-seven coops on exhibition there were very few which would not have done credit to the intelligence and skill of their breeders. When we look back to former exhibitions, and remember the many cages of disqualified fowls, showing that their owners had hardly learned the A B C of the science of careful breeding, the contrast is a highly gratifying one; for it shows that the farmers of Bristol County have devoted brains as well as time to the culture of this not unimportant department of husbandry.

The efforts of the many poultry societies, the seeds of knowledge planted through the instrumentality of their annual exhibitions, and the high standard of excellence demanded by them in their specialties, have done much to bring about the results which have been brilliantly illustrated to-day. It is beginning to be acknowledged that it pays to give serious attention to this department of rural economy, that pure bred fowls — commanding higher prices than mongrels, and certain to produce chickens which will retain and transmit the superior merits of their progenitors — cost no more to raise, and are greatly more remunerative, than are the accidental crosses, which may or may not have the qualities of their parents.

THE VALUE OF THE POULTRY PRODUCT OF BRISTOL CO.

The aggregate value of the poultry product is no insignificant one. The following statistics, gleaned from the State census of 1875, will be found interesting: —

The aggregate value of live poultry was $96,305; the county also furnished the same year, of dressed poultry, 103,183

fowls for $23,729; dressed turkeys, 18,117 for $4,500; making total valuation, according to the State census, $124,335.

In the above computation there is no account of the egg product. In 1875 there were in the county 28,561 families. Estimating the weekly consumption (including bakers' supplies,[1] cake, &c.) at one dozen and a half for each family, the amount would be, at sixteen cents per dozen, $5,054 per week, or $262,808 per annum. The annual product of manure from the poultry of the county, which consists of 144,360 hens and chickens, 1,939 ducks, 1,389 geese, 1,728 turkeys, would amount, at a much lower valuation than Mr. Geyelin gives in his able treatise on "Poultry Breeding from a Commercial Point of View," to at least $30,000; which swells the total value of the poultry amount to the imposing sum of $417,343 more than the value of all the bulls, colts, heifers, hogs, lambs, calves, oxen, and mules in the county.

In the above computation no allowance is made for any increase of population within the last three years (which is considerable, the increase in the ten years preceding the census being about thirty per cent), nor for the corresponding increase in the poultry product, which has been a marked feature. A close scrutiny of the census returns convinces us that the returns are not complete. It gives the number of ducks in New Bedford and Fairhaven as one hundred and seventy-nine, when, to the writer's personal knowledge, not less than three hundred and fifty can be counted in one day. Again, the valuations vary greatly. Forty-one geese in Fall River and thirty-five in Fairhaven are valued at ninety-five dollars, while forty-eight in Attleborough are valued at ninety-six dollars, — nearly double the price of the former. A pair of pea-fowl in Seekonk is valued at only two dollars, while a pair in Taunton is valued at eight dollars, the last not a high valuation. These instances might be multiplied; but they are only given to show that fancy prices have not entered to any extent as an element in the census returns. One or two other facts gleaned from these returns may not be uninteresting. Dartmouth is the banner town of the county, being credited with 25,784 hens and chickens, 466 ducks,

[1] Two bakers in New Bedford give their yearly consumption of eggs seventy-five hundred dozen each, or twenty-five dozen daily.

273 geese, and 378 turkeys. Westport comes next, with 21,502 hens and chickens, 825 geese, 306 ducks, and 273 turkeys. The whole number of the last is rather a poor showing for the "king of poultry," there being only 1,725 in all.

THE POPULAR BREEDS.

The examination of the cages exhibited shows that the Light Brahmas and Plymouth-Rocks, Leghorns, and Hamburgs, have retained their popularity in a marked degree, the sterling merits of these breeds being justly appreciated. There were only two cages of Crève-Cœurs and Houdans. It is to be regretted that more of our breeders do not turn their attention to the latter especially. For hardihood, laying qualities, and as poultry for the table, they have no superiors. The writer bred them for years side by side with Games and Dorkings, losing no chickens by disease, when he lost one out of four of the Dorkings, and one out of ten of the Games. They were interminable layers; and the only reason he at last got rid of them was for want of accommodations for the relays of sitting hens which he was obliged to buy every spring. This objection would certainly not apply on a farm where there is plenty of room.

The show of game-fowls was exceptionally fine, being by far the best collection ever exhibited on these grounds. For beauty and splendor of plumage they have no peer among poultry. There has been, however, a marked deterioration in form within the last few years.

The aim of the high-class fancier now is apparently to produce a bird as nearly as possible like those which have been trimmed, and prepared for the cock-pit. In place of the exquisite, curving, lustrous tail of former years, which sprang proudly from his back, a fountain of beautiful plumage, black in the shadow, and flashing iridescent green in the sunlight, we have the contemptible whip-tail (well named; for it gives the bird a whipped appearance before he has fought), and long, lanky neck, which only the beauty of plumage makes tolerable, and which is, no doubt, the result of a cross with the Malay. We believe that the present style of game-fowl will have its day, and that the large number of breeders to whom the cock-pit is a horror and an abomination will introduce a better standard hereafter.

CARE OF POULTRY.

It has been customary with chairmen of this Committee to make a few suggestions from year to year in regard to the attention and care necessary for poultry. The ground has been so well covered, that it is hardly possible to say any thing new on the subject.

There are two vital points which we would dwell upon for a moment. First, cleanliness, in order to insure complete immunity from lice, which can only be secured by the frequent use of whitewash, sulphur, and carbolic acid, or kerosene-oil upon the roosts, together with frequent cleansing of the floor, and occasionally fresh earth or sand; and, second, the importance of plenty of grass or green vegetable matter.

If these are adopted as of prime necessity, there will be little difficulty in raising poultry successfully. Roup and other diseases will become almost annihilated. From careful observation of many years, the necessity of grass seems to be greatly underrated. How often do we see thirty or forty fowls shut up during the summer months till they become sickly, when a daily supply of grass would keep them healthy!

The writer had a flock of forty to fifty Plymouth-Rocks in his barnyard during the summer months. They were supplied with fresh cut grass nearly every day. They would sometimes consume a two-bushel basket full twice in a single day. We lost only one fowl by disease during the whole season, and this was a case of apoplexy. How many persons who shut up their fowls in contracted quarters provide them with any thing like this amount of grass? yet it is highly important.

As a cheap and easy method of securing good grass runs, we would recommend the use of seine-netting for temporary enclosures. It can be bought second-hand as low as two cents per pound; but perhaps the cheapest in the end would be the new tarred netting. This is used quite extensively by farmers in Westport, living not far from the seashore, and answers the purpose of cheap fencing admirably.

In many cases the kitchen-garden could be surrounded by this netting ten feet high, which would give the poultry free range over the farm. The nearer we can follow nature in

these matters, the better. If to shut up fowls is a stern necessity, then supply them with fresh ranges of grass every two or three weeks, if possible. A dollar or two spent in this cheap fencing will be repaid many times before the end of the season.

In conclusion, we would thank all who contributed to make our department a success. To farmers we would say, by all means encourage the love of poultry in your boys and girls. It will add to the charm of the old homestead, it will educate their æsthetic taste, it will make them better fitted to enjoy the healthful and innocent pursuits of country life hereafter. It will make the boys better farmers, better breeders of stock, and will multiply in many ways their sources of enjoyment and profit.

EDMUND RODMAN, *Chairman.*

WORCESTER WEST.

[From the Report of the Committee.]

Your Committee expected to see an improvement in keeping with the good judgment of the progressive farmers of this part of Worcester County; but those of them who had been familiar with the exhibitions for many years were not prepared to see such a vast increase in numbers and quality, or so much interest manifested by the general public, who pay their gate-money to see the fair. Much of the time it was difficult to move about among the crowd of eager questioners.

Some farmers and their families have known for years of the profit of well-cared-for poultry; but until periodicals came to be published treating of poultry-raising and its profits especially, and a few secretaries of agricultural societies devoted a share of their official time to the subject, the knowledge was very limited. It is a well-authenticated fact, that the poultry interest is one of the foremost of the farmer's interests; and though within a few years many wise ones have predicted that "the fever" was about burnt out, &c., still there is no branch of the farmer's business that is increasing so rapidly, or that has more room to continue its

progress. Why? Because there is no other branch that will pay so large a per cent profit on an investment when properly managed. I have questioned many intelligent gentlemen and ladies in relation to their opinion of poultry raising and egg-production in various parts of the country, and invariably they allow a profit of from one to three dollars to a fowl when properly managed, and due regard is paid to selecting varieties for particular purposes.

The most profitable branch of poultry-husbandry is the production of eggs; and there is no danger of its being overdone. I have given my attention to this branch in particular, keeping always in view the fact that a really first-class article brought the best profit; and my experience of many years has proved that to get the best profit, and do it the easiest, fowls must be always confined, as also that a thorough-bred fowl was as much better than a mongrel as was any other thorough-bred animal.

THE EGG.

The quality of the egg for table or breeding purposes depends, first, upon the condition of the fowl that lays it, and, second, upon the quality of the food from which it is made. I can keep my fowls in better condition when closely confined; for then I can control the atmospheric and all other surroundings and quality and quantity of food, also their exercise. The temperature should not fall below forty degrees, nor rise above seventy-five degrees; and the atmosphere should be dry at all times, as should the floors of the poultry-house. They should have enough material furnished at regular intervals to keep up the waste of their systems, and to manufacture what eggs we expect them to lay, with a little to waste by the process of digestion. The farmer who knows how to feed cows to make milk will know what to feed his hens to make eggs; for the substance of the egg and of milk is very similar. Where most farmers fail is in feeding their fowls too much Indian corn. It will fatten mature fowls, but is poor material to make eggs of.

CHICKENS.

I have for several years used my sitting hens as constant incubators to hatch my chickens. Can hatch as many chickens with twelve hens now as used to take fifty for, and, as

sitting hens are a nuisance when not wanted, am glad to be rid of them. Can raise a very much larger per cent of chickens by hand than a hen will raise, and at a less expense. Chickens raised by hand in confinement are more tractable, grow faster, lay earlier, and lay more eggs. Hens properly cared for will sit from February to August, and then be in better condition to eat, or put to laying eggs, than if they had been running with chickens. The chickens require a place heated in some way to about a hundred degrees till they are three days old, with plenty of air; then mercury may fall to eighty degrees or eighty-five; and Brown Leghorns, at one week old, will stand sixty to seventy degrees, and do well, if they have plenty of nutritious food. Like almost every thing else, the heat of the sun is the best for them; and in a cold-frame, when the sun shines, they are all right even in pretty cold weather (part should be covered with boards for a shade). I have boxes (cheese-boxes are just the thing) that are well ventilated, and let twenty to thirty-five occupy a box; and they will soon learn to huddle in them when there is a change to cold in their runs; and, after they are a week old will soon have a warm place from their own heat.

FEEDING CHICKENS.

On this depends the success of the poultry man or woman. Get your chicks well started on good nutritious food, and then one-half the work of raising is done. I feed yolks of eggs boiled hard and made fine (a three-tined fork will do it), and mixed with dry crackers made fine, or bread-crumbs, for a week, giving them plenty of fresh water that they can go to any time they please. Indian meal mixed with new milk, and baked a long time till dry, and then pulverized, is as good a grain-feed as I ever gave chickens for two weeks, when they can begin to eat crushed wheat and small kernels some, and fine scraps (beef-scraps are best), or some other animal food or milk, one feed a day, and one or two feeds of green globe Savoy cabbage leaves or heads, or some other tender, raw vegetable (if grass or clover, it should be made fine), one-half inch long. Boiled or baked potatoes, apples or squashes, or mashed raw potatoes or apples, are devoured with avidity, and make a nice living for one feed a day. The sexes should be separated as soon as they can be dis-

tinguished, and put in separate runs. The cockerels of the Leghorn varieties can be told from the pullets when four weeks old; and at this age the chickens intended to be kept for laying and breeding purposes can be fed the same as laying fowls, putting those too poor for either into close quarters. Boxes three feet long, two feet wide, and two feet and a half high, will accommodate four pairs, if dry sand or loam is put in once a week, and water kept out, until you want to kill them. They should be tight except a few holes for ventilation (inch holes distributed around), and the front should be slatted so you can feed the chicks outside, with a slide-door in centre to get the arm in to catch chickens. After the chicks have been fed good scalded meal-dough pretty dry, or boiled potatoes and meal equal parts, all they will eat, make the box as dark as possible (and leave ventilation enough) until you want to feed again. Three times a day, I find enough for fattening chickens, and twice a day, for all other fowls and chickens after they are four weeks old. Previous to four weeks old, they want feeding all they will eat up clean every two or three hours through the day. I never disturb my chicks at night to feed them, and don't feed them after five o'clock P.M. in summer, or four o'clock P.M. in fall and winter.

WHAT TO FEED LAYING HENS.

This is a serious question, and the rock where most amateur poultrymen get their bark astrand. As I have said before, the farmer who reads knows that the composition of eggs and milk is very similar; and what will make lots of good milk will make lots of good eggs, if you have laying hens instead of sitting hens. Still there is this difference: you may feed a cow, and get the most possible returns in milk, and be fattening her for the butcher at the same time. Not so with biddy. As soon as she begins to get fat, she will begin to lay soft-shelled eggs; then, perhaps, no eggs at all for a while; and then you will find her dead on the nest or somewhere else, stricken with apoplexy if a laying hen. If a sitting breed, she will get broody, and be put to incubating eggs, and after breaking a few, and smothering the few chicks she may hatch, she will be thrown into some place in disgust by her master, when the fault was his. All the Indian meal I

feed my laying or sitting hens or growing chickens is what I use mixed with ground oats, equal parts by measure : this mixture is reduced still more by mixing two parts coarse shorts, and one part wheat, whole (by measure) ; or, in place of the wheat, use oats, barley, or buckwheat. And I feed ground beef-scraps two quarts to ten of grain, also one quart fine charcoal, or a spoonful of wood-ashes, stirring the mass thoroughly before wetting. I mix with boiling water. In warm weather I mix in morning, and let it stand till two o'clock P.M., and feed as my last grain-feed for the day: I feed raw vegetable food of some kind after this is eaten up all the fowls or chicks will eat.

In cold weather I mix my feed in same way just at night, cover it up, and in a moderately warm place it will be warm for morning feed. I use the coarse part of coarse cracked Southern corn two parts, two parts of good quality wheat, oats, barley, or buckwheat, and one quart of ground oystershells, to ten quarts of the grain, for morning feed in warm weather, and an afternoon feed in cold weather. I keep a good deal of coarse litter, leaves, hay, straw, or weeds, as case may be, in rooms, and scatter my dry feed around amongst it, allowing a small handful to a full-grown fowl, and the same to two half-grown chicks. I feed a quantity of raw feed after the dry, same as after the scalded, and see that all the fowls and chickens, except those that are fattening, have clean, fresh water after their morning and afternoon feed. I give the fattening fowls or chicks raw food once or twice a week, and water same or not, as case may be. If they are fed on scalded or wet up food or swollen grain, they don't need water. I think it pays to grind or soak and swell all grain before feeding. And I have the best luck with cooked food for fattening poultry.

F. J. KINNEY, *Chairman.*

THE DAIRY.

FRANKLIN.

[From the Report of the Committee on Butter and Cheese.]

Your Committee found, when they entered upon their duties, eighteen packages of butter for their examination, and thirteen of cheese, showing a commendable interest in a goodly number of the members of our society to sustain the reputation we have gained in this department of our exhibition. All these packages presented a neat and tidy appearance, and should be pronounced good; but, when tested, they proved to possess varying degrees of merit. We indicated them by affixing the society's prepared labels to those packages which in our judgment were deserving the greatest merit.

In making our decisions and affixing the awards, we did not take into consideration the various methods pursued in their preparation, nor the class of cows of which these were the natural products; but we were guided solely by their intrinsic merits as they appeared to us, and rendered our judgment accordingly: and this was done after an ever varying and diverse criterion. We carefully tasted every entry; and that which left in the mouth and throat the most pleasant and agreeable sensation, or, when used as food, could be regarded as a real luxury, we decided took precedence over all others, and so received the first award, and the others by the same rule in their relatively descending order.

In bestowing the first and second premiums upon both the butter and cheese, we found such a slight shade of difference in taste and flavor, as they were so nearly alike, that it was only after the most patient and discriminating testing that we could decide which deserved the title of best and better; but after that was done the work was comparatively easy.

Why it was so is also very easy for us to state. It was,

that, in the butter, we detected the presence of buttermilk and an undue degree of salt, and, in the cheese, a too smart and strong taste, that would render them unpalatable to us.

The use of too much salt in butter is a fault with too many dairymen. Whether it is done to meet the demands of the popular taste, to increase its weight, or add to its keeping qualities, we do not know; but the fact was perfectly apparent; for, in some packages presented for our examination and award, there was an amount of salt, that, when tasted, left a burning and painful sensation in the mouth, and when swallowed made its unpleasant presence distinctly felt by the delicate membranes of the throat. Salt is good; but an overdose is an evil when used as an article of food, and in our judgment this accusation would justly lie against a majority of the entries of butter. So, too, in two or three instances we distinctly detected the presence of buttermilk. When used in a fresh state, this is not so objectionable as oversalting; but whenever it remains, even in small quantities, it reduces the quality, so that, whatever may be its other merits, it cannot be ranked as prime or first-class butter.

At our examination we did not carefully read all the statements appended to the several entries; but those belonging to the specimens of which we made honorable mention were taken by us to be read at our leisure. But they were mislaid, and so lost; which fact we greatly regret, as without them we cannot make our report complete, so that now we have no means of learning the methods employed in their preparation.

These two were the main faults we detected in the packages offered for our inspection, and these we think can be easily remedied. With two packages, with their exceeding saltness, there was a slight degree of rankness, which detracted from their value. This might have been for want of proper care of the utensils used in their production; or the milk might have been kept in an unsuitable room; or it might have been in the quality of the salt used. If there is lime in the salt, that will in a short time give to butter a bitter, rank, or strong taste, and make that which otherwise would be a superior article an inferior one. Hence only the purest salt should be used in butter and cheese making; and this is found to be, after careful analysis, either the Ashton (an

English salt) or the Syracuse (made especially for the use of the dairy). If you do not use either of these kinds, ask your merchant to get them, so that henceforth you may have a full supply of the purest and best salt.

Of course tastes differ. What would be objectionable to one would be satisfactory to another; yet it is true that that butter which is not over-salted generally commands the highest price in the Boston market. The right proportion is about eight ounces of salt to ten pounds of butter; while that which is made for the Parker House, Boston, receives but six ounces to ten pounds of butter. Of course it must be fresh, put up in a neat and attractive form, have a firm and waxy texture, and possess that peculiar butyraceous fragrance which unmistakably indicates its true quality. For such butter, even in these times of over-supply, there is a constantly increasing demand. Does it not, then, become our farmers and dairymen that this demand be met? Judging by what was before us, it is certain that this is done in part. Why not in all, so far as our means will allow?

To do this we must not only have the best cows, the best pastures, feed the best food, have the best appliances, but put the best thought into our work, and success is assured, not as the exception, but as the rule.

The dairy, with most of the farmers of our society, is one of their principal means of support. It is not only for their interest that they make the best article of butter and cheese, but it is their duty and privilege also. To this end we should not only know how this work can be done, but we should resolutely and intelligently set ourselves at work to do it, and so not only be able to satisfy the demands of a pure taste, but do our share towards cultivating a purer and more delicate taste in the community among all people.

We repeat, then, that our prosperity is so dependent upon our dairies, it becomes a matter of the first importance that we not only aim to make the best butter and cheese, but that we do it, for not only is our pecuniary welfare involved, but our intellectual and moral; so that with an increase of means there shall be a corresponding increase of manly character, that at all times and in every thing will scorn to speak a low word or do a mean act.

Of the cheese we must speak briefly; for what we have

said of the butter, in general, is applicable to the cheese. The outward appearance of all was very much alike, showing that it had received the best of care; but the inward condition was very unlike. The reasons for this unlikeness we are not able to state. With two or three exceptions, there was not that mildness and blandness that were pleasant to our tastes; with the rest there was a smartness or rankness, that, when taken into the mouth and left to melt upon the tongue, produced a disagreeable sensation. Whether this was owing to the quality and quantity of the rennet, the quality and quantity of the salt, or the temperature of the milk during the time of its handling, we are not prepared to say; but the fact was very apparent. Neither are we able to suggest a remedy; but while each class, the smart or strong, may have its friends, to us a mild, pleasant cheese meets the condition of our tastes, and we could wish that all who are engaged in this industry, whether individually or collectively, would so study their art, and practise their calling, that, without failing a single time, they will produce a mild, pleasant, and delicious article of food, that will minister to human pleasure, and satisfaction in its consumption.

S. Barber, *for the Committee.*

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